

Mitchell Mark Holland
Curriculum Vitae

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Education:

Honorary Doctorate, Faculty of Science, School of Medicine, and Department of Forensic Sciences, University of Split, Croatia. 2017

Postdoctoral Fellow, The Johns Hopkins University School of Medicine, Department of Pediatrics, Baltimore, Maryland. 1990

Ph.D. in Biochemistry, The University of Maryland, College Park, Maryland. 1989

Mentor: John A. Gerlt, Currently Professor of Biochemistry, Gutgsell Chair, Professor of Chemistry, and Professor of Biophysics and Computational Biology, School of Molecular and Cellular Biology, University of Illinois

B.S. in Chemistry, Hobart College, Geneva, New York. 1984

Employment:

2019-Present Professor, Biochemistry and Molecular Biology, Forensic Science Program, The Pennsylvania State University, University Park, PA

2017-Present Acting Laboratory Director, Mitotyping Technologies, a SoftGenetics Company, State College, PA

2005-Present Founder, Forensic DNA Consultants, Port Matilda, PA

2009-2014 Director, Forensic Science Program, The Pennsylvania State University, University Park, PA

Undergraduate Program FEPAC Accredited (2009, reaccredited in 2014)
Master's Program FEPAC Accredited (2012)

2005-2019 Associate Professor, Biochemistry and Molecular Biology, Forensic Science Program, The Pennsylvania State University, University Park, PA

2005-2009 Associate Director, Forensic Science Program, The Pennsylvania State University, University Park, PA

2000-2005 Senior VP, Operations and Laboratory Director (2003-2005) and VP, Laboratory Director (2000-2002), Bode Technology Group, Springfield, VA

1991-2000 Scientific Laboratory Director (1993-2000), Head of Research (1992-1993), and Research Scientist (1991-1992), Armed Forces DNA Identification Laboratory, Office of the Armed Forces Medical Examiner, The Armed Forces Institute of Pathology, Rockville, MD

1990-1991 Research Associate, Sinai Hospital, Department of Surgical Research, and Johns Hopkins Hospital, Baltimore, Maryland

Professional Affiliations, Special Appointments, Testimony:

American Academy of Forensic Sciences, Fellow

Editorial Board Member for *Genes*, 2021-Present

Head, Module II, Master of Forensic Science, University of Split, Split, Croatia, 2016-Present

Member & Scientific Committee Member, International Society for Applied Biological Sciences, 2004-Present

American Academy of Forensic Sciences, Diversity Committee, Member, 2019-2020

Advisory Board Member of the Fundacion de Anthropologia Forense de Gualemla (FAFG) forensic DNA laboratory located in Guatemala City, Guatemala, 2009-2010

Certified as a Laboratory Director by the State of New York, Department of Health, 2003-2007 and 2017-2021.

Editorial Board Member for the *Journal of Forensic Sciences*, 2000-2010

Associate Graduate Faculty, Forensic Science Program, Marshall University Huntington, WV, 1997-1999

Advisory Board Member for the *International Journal of Legal Medicine*, 1996-2007

Adjunct Assistant Professor, Department of Obstetrics and Gynecology, University of Maryland at Baltimore, 1994-1999

Associate Professorial Lecturer in Forensic Sciences, Department of Forensic

Sciences, George Washington University, Washington, DC, 1993-2000 (Course Number: Forensic DNA Profiling 254)

Member of the Scientific Working Group on DNA Analysis Methods (SWGDM), FBI Academy, 1992-2000

American Society of Human Genetics, Previous Member

Other Editorial Activity: American Journal of Human Genetics, Biotechniques, Croatian Medical Journal, Electrophoresis, Forensic Science International Genetics, Forensic Science Reviews, PlosOne, Genes, Journal of Biological Chemistry

National Institutes of Justice Grant Review Board, 1996, 1997, 1999, 2007

Testified: More than 20 Times

Teaching Vision & Experience:

Vision: Learning is an active process. An engaged student will have an enhanced and enriched experience. Therefore, utilizing effective teaching tools to establish an active learning environment is a primary goal of my teaching style.

BMB 400: Molecular Biology of the Gene (15 semesters)

FRNSC 100: Introduction to Forensic Science (2 semesters)

FRNSC 400: Courtroom Proceeding and Testimony (11 semesters)

FRNSC 421W: Forensic Molecular Biology w/ Lab (19 semesters)

FRNSC 475: Forensic Science Seminar (2 semesters)

FRNSC 485W: Capstone in Forensic Science (co-taught 13 semesters)

FRNSC 497A: Historic Forensic Identification (co-taught 2 semesters)

FRNSC 561: Ethics in Forensic Science (1 semester)

FRNSC 597: Forensic Statistics (1 semester)

FRNSC 821: Advanced Forensic Molecular Biology (14 semesters)

FRNSC 894: Research Methods (3 semesters)

PSU016: Forensic Science Freshman Orientation (5 semesters)

Also taught a Forensic Molecular Biology course while an Associate Professorial Lecturer in Forensic Sciences at GW University; Forensic DNA Profiling 254.

Service to the University Community:

Member, Undergraduate & Graduate Education Committee, Forensic Science Program, 2005-present

Member, Graduate Recruitment Committee, Forensic Science Program, 2006-present

Faculty Champion, Global Programs Initiative between Penn State and the University of Split, Croatia, Appointed by the Vice-Provost for Global Programs, 2017-2020

Member, Honors Advisors Committee, Department of Biochemistry & Molecular Biology, AY19/20

Member, Associate Dean Review Committee, Eberly College of Science, AY19/20

Member, Peer Teaching Evaluation Committee, Department of Biochemistry & Molecular Biology, AY19/20

Member, Diversity & Outreach Committee, AAFS, 2019-2020

Member, Faculty Search Committee, Vice Provost for Global Programs, 2019

Member, Selection Committee, Schreyer Honors College Applicants, 2019

Member, Search Committee, Strategic Engagement (GEN) Coordinator for Global Programs, 2017

Co-Leader (with Martin Trethewey), Global Programs Initiative between Penn State and the University of Split, Croatia, Vice-Provost for Global Programs, 2015-2017

Member, Zagreb GEN Task Force (exploring the development of strategic relationships between Penn State and the University of Zagreb, Croatia), Vice-Provost for Global Programs, 2014-2015

Member, Dean's Executive Committee, Eberly College of Science, 2011-2014

Board Member, Eberly College of Science Online Education, 2011-2013

Member, Search Committee, Associate Deans (two searches, Undergraduate Education & Graduate Research), 2011

Advisory Board Member, Center of Excellence in Science Education, Eberly College of Science, 2010-2018

Director, Forensic Science Program, 2009-2014

Member, Search Committee, Eberly College of Science, Director of Outreach, 2007

Member, Eberly Outreach Council, 2007-2011

Associate Director, Forensic Science Program, 2005-2009

Outreach Activities: AAFS CSI Camp (June 16-19, 2014), ScienceU CSI DNA Camp (July 7-11, 2014), and Forensic Science at ArtsFest (July 11-12, 2014)

Invited Lectures (since 2013):

- 2020 Bode 2020 Forensic DNA Conference, *Assessing DNA Damage in mitoMPS Data from Low Template Samples*, Virtual Conference, 27 October 2020
- 2019 International Society for Applied Biological Sciences, 11th Symposium, *DCMPS of mtDNA Heteroplasmy: An Established Tool for Forensic Investigations*, Split, Croatia, 18 June 2019
- Promega Tech Tour, NJ State Police Forensic Technology Center, *DCMPS of mtDNA Heteroplasmy: An Established Tool for Forensic Investigations*, Trenton, NJ, 8 October 2019
- 2018 FIU Promega Workshop, *Deep-Coverage MPS Analysis of Heteroplasmic Variants within the mtGenome Allows for Frequent Differentiation of Maternal Relatives*, Miami, FL, 1 May 2018
- Washington State Patrol Promega Workshop, *Deep-Coverage MPS Analysis of Heteroplasmic Variants within the mtGenome Allows for Frequent Differentiation of Maternal Relatives*, Seattle, WA, 6 June 2018
- Green Mountain Conference, *Deep-Coverage MPS Analysis of Heteroplasmic Variants within the mtGenome Allows for Frequent Differentiation of Maternal Relatives*, Burlington, VT, 30 July 2018
- 2017 Illumina Workshop, AAFS Conference, *MPS of Highly Fragmented nDNA & the mtDNA HVRs on the MiSeq FGx*, New Orleans, LA, 17 February 2017
- Hobart & William Smith Colleges, *Forensic DNA Testing as a Tool for Reducing Human Trafficking & Addressing Acts of Genocide*, Geneva, NY, 13 April 2017
- Hobart & William Smith Colleges, *Considering DNA Damage when Interpreting mtDNA Heteroplasmy in Deep Sequencing Data*, Geneva, NY, 14 April 2017
- Centre of Forensic Sciences, *Assessing the Impact of DNA Damage on the Interpretation of MPS mtDNA Data*, Toronto, Canada, 16 May 2017
- The Armed Forces DNA Identification Laboratory, *Reporting mtDNA Heteroplasmy: Thresholds, Match Criteria, and Statistics*, Dover, DE, 7 June 2017
- International Society for Applied Biological Sciences, 10th Symposium, *Rates, Damage & Drift: Considerations when Assessing mtDNA Heteroplasmy*, Dubrovnik, Croatia, 22 June 2017

University of Split, Split, Croatia, Honorary Doctoral Degree Presentation, *A Lifetime of Mitochondrial DNA: It's Essential*, Split, Croatia, 15 December 2017

2016 NIJ Grantees Workshop, AAFS Conference, *Measuring Rates of mtDNA Heteroplasmy Using a NextGen Sequencing Approach*, Las Vegas, NV, 23 February 2016

Genetics in Forensics Congress, *Measuring Rates of mtDNA Heteroplasmy in European Populations Using a NextGen Sequencing Approach*, London, UK, 15 March 2016

CA DOJ Promega Workshop, *Measuring Rates of mtDNA Heteroplasmy Using a NextGen Sequencing Approach*, San Francisco, CA, 12 April 2016

NYC OCME Promega Workshop, *The Impact of Using a Proofreading Enzyme when Performing MPS Analysis of mtDNA*, NY City, NY, 28 June 2016

International Symposium on Human Identification, *Best Practices for Reporting mtDNA Heteroplasmy when Using an MPS Approach: Considering Rates, DNA Damage & Drift*, Minneapolis, MN, 29 September 2016

Bode Mid-Atlantic: DNA & Investigators Conference, *Massively Parallel Sequencing in Forensics: Past, Present & Future*, Philadelphia, PA, 7 November 2016

2015 Ft. Derick, STEP Biosciences Working Group, *mtDNA Heteroplasmy and NextGen Sequencing: A perfect Marriage*, 27 May 2015

9th International Society for Applied Biological Sciences, Split, Croatia, *mtDNA Heteroplasmy and NextGen Sequencing: A perfect Marriage*, 25 June 2015

NC State University, Forensic Sciences Institute, *Measuring Rates of mtDNA Heteroplasmy Using a NextGen Sequencing Approach*, 15 September 2015

2014 NC State University, Forensic Sciences Institute, *Rates, Transmission and Forensic Applications of mtDNA Heteroplasmy*, 2 May 2014

The Armed Forces DNA Identification Laboratory, *Rates, Transmission and Forensic Applications of mtDNA Heteroplasmy*, 9 October 2014

West Virginia University, Biology Department, *Rates, Transmission and Forensic Applications of mtDNA Heteroplasmy: assessing maternal age effects and human germ-line bottlenecks*, 10 November 2014

- 2013 American Chemical Society, *Rapid Testing: Is It the Future of Forensic DNA?*, 27 March 2013
- 8th International Society for Applied Biological Sciences, Split, Croatia, *NextGen Sequencing for Human Identification*, Forensic Applications of Next Generation DNA Sequencing Workshop, 26 June 2013
- Huck Institute, Weekly Genomic Seminars, *The Legal Impact of the ENCODE Project on Forensic DNA Analysis*, 31 July 2013
- 24th International Symposium on Human Identification, Workshop on Next Generation DNA Sequencing, *mtDNA Heteroplasmy: Detection, Reporting & Transmission Using an NGS Approach*, 7 October 2013

Continuing Education & Workshops:

- Workshop Chair, University of Split, “Bioinformatic Solutions for Real-World Next Generation Sequencing”, 14 June 2019
- Workshop Chair, 29th International Symposium on Human Identification, Phoenix, AZ, “The Future is Now for MPS mtDNA Analysis”, September 2018
- Workshop Organizer, University of Split, Split, Croatia, “Complex STR Mixture Interpretation Workshop”, with a total of 15 attendees from a private company and the Police Laboratory from Zagreb, June 2015
- Workshop Co-Organizers, MN BCA, St. Paul, MN, “Advancing Human Forensic DNA Analysis Using Next Generation Sequencing (NGS) Technology”, with a total of 32 attendees from the Tri-County Regional Forensic Laboratory (TCRFL), Anoka County Sheriff’s Office, in Andover, MN (North of Minneapolis-St. Paul, MN), the Hennepin County Sheriff’s Office (HCSO) Crime Laboratory (Minneapolis, MN), and the MN BCA Crime Laboratory (St. Paul, MN), June 2015
- Session Organizer, 8th International Society for Applied Biological Sciences, Bi-Annual Meeting, Split, Croatia, session: “NextGen Sequencing for Human Identification”, June 2013
- Workshop Organizer, Mid Atlantic Association of Forensic Scientists, Annual Meeting, Virginia Beach, VA, workshop: “DNA Mixture Interpretation”, May 2011
- Workshop Organizer, 21st International Symposium on Human Identification, San Antonio, TX, workshop: “LCN STR Analysis”, October 2010
- Co-Workshop Organizer, Mid Atlantic Association of Forensic Scientists, Annual Meeting, State College, PA, workshop: “DNA Mixture Interpretation”, May 2010

Co-Workshop Organizer, Penn State University, University Park, PA: "Forensic Science Workshop Series: From the Scene to the Classroom - Biology and Bioterrorism", June 2009

FBI DNA Auditor Training, Phoenix, AZ, October 2005

Workshop Organizer, Study Abroad Program through Penn State University and the University of Zagreb, Zagreb and Split, Croatia, "LCN STR Analysis", June 2008

Co-Workshop Organizer, American Academy of Forensic Sciences (AAFS), Chicago, IL: "Extracting DNA from Challenged Samples", February 2003

Co-Workshop Organizer, the 10th International Symposium on Human Identification, Orlando, FL: "MtDNA Sequence Analysis in Forensic Casework: Methods and Current Issues", September 1999

Co-Course Director, MtDNA Training Course (two weeks), George Mason University, Prince William County Campus, The Institute for Biosciences, Bioinformatics, and Biotechnology, Manassas, VA, November 1998

Co-Workshop Organizer, the 2nd European Symposium on Human Identification, Innsbruck, Austria: "MtDNA Sequence Analysis in Forensic Casework: Methods and Current Issues", June 1998

Co-Organizer, AFDIL, Washington, DC: "The First International Workshop on Human Mitochondrial DNA", October 1997

Faculty Member, University of Split, Croatia: "The First European-American Intensive Course in PCR Based Clinical and Forensic Testing", September 1997

Organized and Attended, "Statistical Genetics for Forensic Scientists", by Bruce Weir, Rockville, MD, September 1997

Workshop Faculty Member, AAFS, New York, NY: "Adv DNA Technologies: Automation and Application", February 1997

Workshop Faculty Member, AAFS, Nashville, TN: "Advanced DNA Technologies", February 1996

Workshop Faculty Member, AAFS, Seattle, WA, workshop: "Implementation and Consequences of New DNA Technologies: The Sequel", February 1995

Course Co-Director, AFIP and American Registry of Pathology, in conjunction with Uniformed Services University of the Health Sciences, Bethesda, MD, "Methods and Advanced Techniques in Human Identification", June 1994

Workshop Faculty Member, The American Academy of Forensic Sciences, San Antonio, TX: "Implementation and Consequences of New DNA Technologies in the Forensic Laboratory", February 1994

Workshop Faculty Member, The Fourth International Symposium on Human Identification, Scottsdale, Arizona: "Practical Techniques in DNA Analysis of PCR Fragments", September 1993

Visiting Research Scientist, FBI Forensic Science Research and Training Center, FBI Academy, Quantico, VA, September-December 1991

Research Funding History: Total Funding Since 2013: \$2,544,153

An Assessment of Probabilistic Approaches to mtDNA Mixture Interpretation, **\$205,963** (100%), National Institute of Justice, 01/01/2021 to 12/31/2021, PI Mitchell Holland, Co-PI Jennifer McElhoe

mtGenome Sequencing of Human Hair Shafts Using an MPS Approach: Drift of Heteroplasmic Variants, Impact of DNA Damage on Data Interpretation, and Other Forensic Considerations, **\$878,274** (100%), National Institute of Justice, NIJ 2016-DU-BX-0045, 01/01/2020 to 12/31/2021, PI Mitchell Holland

Measuring rates of mtDNA Heteroplasmy in Different Population Groups, **\$295,249** (100%), National Institute of Justice, NIJ 2016-DN-BX-0171, 04/01/2017 to 03/31/2018, PI Mitchell Holland

Assessing the Effects of DNA Damage on Next Generation mtDNA Sequencing, **\$654,662** (100%), National Institute of Justice, NIJ 2015-DN-BX-K025, 04/01/2016 to 06/30/2018, PI Mitchell Holland

Measuring Rates of mtDNA Heteroplasmy and Assessing Transmission of Variants, **\$438,790** (100%), National Institute of Justice, NIJ 2014-DN-BX-K022, 01/01/2015 to 03/31/2017, PI Mitchell Holland

Analysis and Assessment of Whole mtDNA Genome MiSeq Data, **\$21,236** (75%), Battelle Memorial Institute, 06/03/2013 to 08/30/2013, PI Mitchell Holland, Co-PI Kateryna Makova (Biology Department) & Anton Nekrutenko (BMB Department)

Assessment of mtDNA Heteroplasmy in Mother: Child Pairs Using a Next Generation DNA Sequencing Approach: Data Acquisition, Analysis & Storage Considerations, **\$49,979** (75%), Battelle VFD IR&D Task 5.3, Battelle Memorial Institute, 01/15/2013 to 04/15/2013, PI Mitchell Holland, Co-PI's Kateryna Makova (Biology Department) & Anton Nekrutenko (BMB Department)

Numerous projects funded by corporate partners (2005-present), with in-kind donations totaling more than **\$600,000**.

Armed Forces DNA Identification Laboratory (1991-2000), internal Federal funding was provided for research (approximately **\$2 M**)

Research Students (Penn State):

Brandon McCollum, *A Scientific Assessment of the Zach Witman Murder Case*, Master's Project (2006-2008, **Graduate Mentor**)

Nicole Brauchle, *STR Analysis of Nuclear DNA Isolated from Telogen Hair Roots*, Master's Project (2006-2008, **Graduate Mentor**)

Megan McQuillan, *Next Generation Sequencing of Forensic Loci Using 454 Life Sciences Technology*, Master's Project (2008-2010, **Graduate Mentor**), Funded by 454 LifeSciences.

Publication: CMJ, *Second generation sequencing allows for mtDNA mixture deconvolution and high resolution detection of heteroplasmy* (2011)

Katherine O'Hanlon, *Examining Mixtures and Low Level Heteroplasmic Variance in Mitochondrial DNA using 454 Life Sciences Next Generation Sequencing*, Master's Project (2009-2011, **Graduate Mentor**), Funded by 454 LifeSciences.

Publication: CMJ, *Second generation sequencing allows for mtDNA mixture deconvolution and high resolution detection of heteroplasmy* (2011)

Dominic Flaim, *Assessment of Levels of Interleukin-6 Receptor (IL-6R) in Postmortem Serum Samples with Regard to Circumstance and Mental State at the Time of Death*, Master's Project (2009-2011, Graduate Committee Member)

Jennifer Nabozny, *Quantification of Bacterial and Human Nuclear DNA from Fingerprints on Various Surfaces Before and After the Application of Lifting Techniques*, Master's Project (2009-2011, Graduate Committee Member)

Kerry McGinley (UG, Honors Student), *Examining Mitochondrial DNA in Human Hair Shafts Using 454 LifeSciences Next Generation Sequencing*, Integrated Master's Project (2010-2012, Honors Adviser, **Graduate Mentor**, Schreyer Honors College), Funded by 454 LifeSciences.

Lauren Rothwell (UG, Honors Student), *Examining Effects of PCR Conditions on mtDNA Heteroplasmy Detection Using Next Generation Sequencing*, Integrated Master's Project (2010-2012, Honors Adviser, **Graduate Mentor**, Schreyer Honors College), Funded by 454 LifeSciences.

Kaylie McGuire, *Multiplex Amplification of Deletion/Insertion Polymorphisms: A New Kit on the Block*, (2010-2012, Graduate Committee Member)

Ayano Fox, *Assessing the Ancestral Origin of Ancient Human Remains from Croatian Burial Sites using Mitochondrial DNA Analysis*, Master's Project (2011-2013, **Graduate Mentor**)

Publication: CMJ, *Cultural inter-population differences do not reflect biological distances: an example of interdisciplinary analysis of populations from Eastern Adriatic coast* (2015)

Liam Phillips, *Reporting Logic for mtDNA Heteroplasmy Using a Next Generation Sequencing Approach*, Master's Project (2011-2013, **Graduate Mentor**)

Rebecca Klein, *Detection of Insertion/Deletion Polymorphisms from Challenged Samples*, (2011-2013, Graduate Committee Member)

Hallie Altshuler, *Substrates, Washing Reagents and Amplification Kits: A Concordance Study Using Direct Amplification*, Master's Project (2012-2014, Graduate Committee Member)

Frank Wendt (UG), *Assessment of the RapidHIT™ Human Identification System for STR analysis of single source samples*, Undergraduate Research Student (2013), Funded by IntegenX, Inc.

Publication: FSIG, *Evaluation of the RapidHIT™ 200, an automated human identification system for STR analysis of single source samples* (2014)

Ashley Silvia, *Evaluation of Forensically Informative SNP Multiplexes Using Next Generation Sequencing*, Master's Project (2013-2015, Graduate Committee Member)

Publication: IJLM, *A preliminary assessment of the ForenSeq™ FGx System: next generation sequencing of an STR and SNP multiplex* (2017)

Nathan Shugarts (UG), *High Throughput Sequencing of Forensically Relevant Single Nucleotide Polymorphisms*, Undergraduate Thesis (2013-2015, Faculty Reader, Schreyer Honors College)

Publication: IJLM, *A preliminary assessment of the ForenSeq™ FGx System: next generation sequencing of an STR and SNP multiplex* (2017)

Alexis Dubin & Erica Pack (UG), *The Analysis of mtDNA Heteroplasmy Using Next Generation DNA Sequencing: Software Comparisons & Concerns*, Undergraduate Research Students (2014), Funded through ECoS Deans Office (\$1000)

Molly Rathbun, *Assessing the Effects of DNA Damage on NGS mtDNA Results & Repair of the Damage*, Master's Project (2014-2016, **Graduate Mentor**), Funded by Illumina, Inc. & FRNSC/BMB.

External Presentations: ISABS & ISHI 2015, AAFS 2016 (oral), MAAFS 2016 (oral)

Publication: FSIG, *Considering DNA damage when interpreting mtDNA heteroplasmy in deep sequencing data* (2016)

Committee Members: Walther Parson (Innsbruck) & Jenifer Smith (DC Crime Lab)

Laura Wilson, *Optimization of First Round Amplification for NextGen mtDNA D-Loop Analysis & Validation of the D-Loop mtDNA Protocol with the Illumina MiSeq* (2014-2016, **Graduate Mentor**), Funded by Illumina, Inc. & FRNSC/BMB.

External Presentations: ISABS 2015, ISHI 2015, AAFS 2016 (oral)

Publication: IJLM, *MiSeq MPS analysis of the mtDNA hypervariable regions with improved enrichment* (2017)

Committee Members: Ann Gross (MN BCA) & Jenifer Smith (DC Crime Lab)

Jaclyn Junod (UG), *Evaluation of DNA Polymerases for the Amplification of the mtDNA Control Region Prior to Next Generation DNA Sequencing*, Undergraduate Research Student (2015), Funded through ECoS Deans Office (\$1000)

Elena Zavala, *Recovery of Highly Fragmented nDNA from Skeletal Material and Subsequent SNP-Based MPS Analysis* (2015-2017, **Graduate Mentor**), Funded through Global Programs, Illumina, Inc. & FRNSC/BMB.

External Presentations: ICMP 2016 (oral), ISHI 2016, ISABS 2017

Awards: NEAFS Carol De Forest Student Research Grant Awardee

Publication: *Impact of DNA degradation on massively parallel sequencing-based autosomal STR, iiSNP and mitochondrial DNA typing systems* (2019)

Committee Members: PJ Perry (Penn State, ANTH) & Tom Parsons (ICMP)

Jamie Gallimore, *Examination of Genetic Drift in Mitochondrial DNA Heteroplasmy in Hair Samples within an Individual* (2015-2017, **Graduate Mentor**), Funded by Promega Corporation, NIJ & FRNSC/BMB

External Presentations: ISHI 2016, AAFS 2017 (oral)

Publication: FSIG, *Assessing heteroplasmic variant drift in the mtDNA control region of human hairs using an MPS approach* (2018)

Committee Members: Ann Gross (MN BCA) & Bob Bever (Mitotyping)

Erica Pack (UG), *A Custom Software Solution for Forensic mtDNA Analysis of MiSeq Data*, Undergraduate Research Student (2015-2016), Funded through ECoS Deans Office (\$1000, poster presentation), and supported by SoftGenetics, Inc.

Publication: FSIG, *Evaluation of GeneMarker[®] HTS for improved alignment of mtDNA MPS data, haplotype determination, and heteroplasmy assessment* (2017)

Alyssa Duffy (UG), *Characterization of Non-Specific Amplification Products Prior to NextGen mtDNA Sequencing* (2015), Funded through ECoS Deans Office (\$1160)

In 2016: *Optimization of First Round Amplification for the Promega PowerSeq 10-Plex & The Impact of Using a Proofreading Enzyme on PowerSeq 10-Plex Analysis*, Funded by the Promega Corporation

Jillian Baker (UG), *Optimization of First Round Amplification for the Promega PowerSeq 10-Plex & The Impact of Using a Proofreading Enzyme on PowerSeq 10-*

Plex Analysis (2016), Funded by the Promega Corporation
Evaluation of Protocol Modifications Intended to Improve the Laboratory Workflow for DNA Extraction at the MD State Police Forensic Science Division (2016-2017), Funded by ECoS Deans Office (\$1000, poster presentation)

Emily (Emmy) Demchak (UG, Honors Student), *Rate of mtDNA Heteroplasmy in Different Population Groups* (2016-2018, Mentor, Schreyer Honors College), Funded by the NIH.
External Presentations: NEAFS 2017 (oral), AAFS 2018 (oral)

Rachel Bonds, *Assessing the Effects of Oxidative DNA Damage on MPS mtDNA Results & Repair of the Damage; Application to Cartridge Casings and Projectiles*, Master's Project (2016-2018, **Graduate Mentor**), Funded by the NIH, Promega Corporation & FRNSC/BMB.

External Presentations: ISHI 2017, AAFS 2018, PA Research Exchange (oral)

Publication: FSIG, *Recovery of mtDNA from unfired metallic ammunition components with an assessment of sequence profile quality and DNA damage through MPS analysis* (2019)

Committee Members: Jodi Irwin (FBI) & Mark Timken (CA DOJ)

Madeline Crowley (UG), *Molecular Age Estimation via Assessment of mtDNA Deletions & Rates of Heteroplasmy*, Funded by the NIH.

Sidney Gaston-Sanchez, *Assessing the Effects of Hydrolytic DNA Damage on MPS mtDNA Results & Repair of the Damage*, Master's Project (2017-2019, **Graduate Mentor**), Funded by the NIH & FRNSC/BMB.

External Presentations: ISHI 2017 & 2018, AAFS 2019, ISABS 2019

Publications: Genes, *A forensic genomics approach for the identification of Sister Marija Crucifiksa Kozulić* (2020); IJLM, *Damage patterns observed in mtDNA control region MPS data for a range of template concentrations and when using different amplification approaches* (2020)

Committee Members: Charla Marshall (AFDIL) & Tom Parsons (ICMP)

Samantha Jarvis, *Soil Characterization Using Elemental and Bacterial Profiles for Forensic Applications* (2017-2019, **Graduate Mentor**), Funded by FRNSC/BMB.

External Presentations: AAFS 2019

Committee Members: Andrew Patterson (Penn State, BMB & CHEM), Frank Dorman (Penn State, BMB/FRNSC)

Troy Adams (UG), *An MPS Approach to Age Estimation Using Methylation Patterns in Genomic DNA & Assessment of a Custom mtpPCR Assay*

Awards: Erickson Discovery Grant (\$1000, poster presented)

Dana Dirnberger (UG), *Impact of Population Source on the Efficiency of PowerSeq WGM & Assessment of a Custom mtpPCR Assay*, Funded by Promega & by ECoS

Deans Office (\$1000, poster presentation)

Katherine (Grace) Marino, *Assessing mtDNA Damage following micro-CT Scanning of Human Skeletal Elements Using a Quantitative and MPS Approach* (2018-2020, **Graduate Mentor**), Funded by NIJ, Promega & FRNSC/BMB.

External Presentations: ISABS 2019

Committee Members: Tim Ryan (Penn State, ANTH), Zeljana Basic & Ivana Kruzic (University of Split, Croatia)

Lauren Canale, *mitogenome Sequencing of Hair Shafts Representing Mock Evidence Using an MPS Approach* (2019-2021, **Graduate Mentor**), Funded by NIJ & FRNSC/BMB

External Presentations: AAFS 2021

Publications: WIREs Forensic Science, *The time is now for ubiquitous forensic mtMPS analysis* (2021)

Committee Members: Walther Parson (Innsbruck) & Adam Garver (OH BCI)

Therese Mandracchia, *Recovering mtDNA and nDNA from Fired and Unfired Ammunition Components: Extraction Comparison & Time Scale Study* (2019-2021, **Graduate Mentor**), Funded by FRNSC/BMB

External Presentations: N/A

Committee Members: Todd Bille (ATF Laboratory) & Craig O'Connor (NYC OCME)

Braden Kump (UG), *Comparison of Differential DNA Extraction Methods: Manual v. SpermX Device*

Sierra Lieb (UG), *Comparison of Differential DNA Extraction Methods: Manual v. SpermX Device*

Alyssa Adesso, *Recovery of Human DNA from Canine Saliva* (2020-present, **Graduate Mentor**), Funded by FRNSC/BMB

External Presentations: N/A

Committee Members: Jason Brooks (FRNSC) & Sree Kanthaswamy (ASU)

Kate Deheer, *Mtgenome & nDNA SNP MPS from Recent and Ancient Hairs* (2020-present, **Graduate Mentor**), Funded by FRNSC/BMB

External Presentations: N/A

Committee Members: Charla Marshall (AFDIL) & Elena Zavala (Max Planck)

Awards:

Honorary Doctorate from the University of Split, Croatia 2017

Award of Merit, American Academy of Forensic Sciences 2010

Presidential Citation, Hobart & William Smith Colleges 2006

Award of Appreciation, Office of the Chief Medical Examiner, NYC 2003

Award of Appreciation, Detectives' Endowment Association, NYPD 2001
Distinguished Service Award, Armed Forces Institute of Pathology 2000
10 Years of Excellence in DNA, The FBI Laboratory 1998
Ralph Hadley Bullard Prize for Achievement in Chemistry, Hobart College 1984
Analytical Chemistry Prize, Hobart College 1983

Publications: Journal Articles & Book Chapters

1. Forensic Aspects of mtDNA Analysis. **MM Holland**, W Parson (2021) Forensic DNA Applications: An Interdisciplinary Perspective; CRC Press, Taylor & Francis Group, Editors Dragan Primorac and Moses Schanfield, submitted May 2021
2. The time is now for ubiquitous forensic mtMPS analysis. LC Canale, W Parson, **MM Holland** (2021) Wiley Interdisciplinary Reviews (WIREs): Forensic Science, e1431
3. Damage patterns observed in mtDNA control region MPS data for a range of template concentrations and when using different amplification approaches. CA Holland, JA McElhoe, S Gaston-Sanchez, **MM Holland** (2021) International Journal of Legal Medicine, 135, 91-106
4. A forensic genomics approach for the identification of Sister Marija Krucifiksa Kozulić. C Marshall, K Sturk-Andreaggi, EM Gorden, J Daniels-Higginbotham, SG Sanchez, Ž Bašić, I Kružić, Š Andelinović, A Bosner, M Čoklo, A Petaros, TP McMahan, D Primorac, **MM Holland** (2020), Genes, 11, 938-950
5. Characterization of background noise in MiSeq MPS data when sequencing human mitochondrial DNA from various sample sources and library preparation methods. JA McElhoe, **MM Holland** (2020) Mitochondrion, 52, 40-55
6. Impact of DNA degradation on massively parallel sequencing-based autosomal STR, iiSNP and mitochondrial DNA typing systems, EI Zavala, S Rajagopal, GH Perry, I Kruzic, Z Basic, TJ Parsons, **MM Holland** (2019) International Journal of Legal Medicine, 133, 1369-1380
7. Recovery of mtDNA from unfired metallic ammunition components with an assessment of sequence profile quality and DNA damage through MPS analysis, **MM Holland**, RM Bonds, CA Holland, JA McElhoe (2019) Forensic Science International: Genetics, 39, 86-96
8. Deep-coverage MPS analysis of heteroplasmic variants within the mtgenome allows for frequent differentiation of maternal relatives. **MM Holland**, KD Makova, JA McElhoe (2018) Genes, 9, 124-145
9. Assessing heteroplasmic variant drift in the mtDNA control region of human hairs

- using an MPS approach. JM Gallimore, JA McElhoe, **MM Holland** (2018) Forensic Science International: Genetics, 32, 7-17
10. Evaluation of GeneMarker[®] HTS for improved alignment of mtDNA MPS data, haplotype determination, and heteroplasmy assessment. **MM Holland**, E Pack, JA McElhoe (2017) Forensic Science International: Genetics, 28, 90-98
 11. MPS analysis of the mtDNA hypervariable regions on the MiSeq with improved enrichment, **MM Holland**, LA Wilson, S Copeland, G Dimick, CA Holland, R Bever, JA McElhoe (2017) International Journal of Legal Medicine, 131, 919-931
 12. Considering DNA damage when interpreting mtDNA heteroplasmy in deep sequencing data, MM Rathbun, JA McElhoe, W Parson, **MM Holland** (2017) Forensic Science International: Genetics, 26, 1-11
 13. A custom software solution for forensic mtDNA analysis of MiSeq data, **M Holland**, J McElhoe (2015) Forensic Science International: Genetics, Supplemental Series 5, e614-e16
 14. Cultural inter-population differences do not reflect biological distances: an example of interdisciplinary analysis of populations from Eastern Adriatic coast, Z Basic, AR Fox, I Anteric, I Jerkovic, O Polasek, S Andelinovic, **MM Holland**, D Primorac (2015) Croatian Medical Journal, 56, 230-238
 15. Evaluation of the RapidHIT[™] 200, an automated human identification system for STR analysis of single source samples, **M Holland**, F Wendt (2015) Forensic Science International: Genetics, 14, 76-85
 16. Maternal age effect and severe germline bottleneck in the inheritance of human mitochondrial DNA, B Rebolledo-Jaramillo, MSW Su, N Stoler, JA McElhoe, B Dickins, D Blankenberg, T Korneliussen, F Chiaromonte, R Nielsen, **MM Holland**, IM Paul, A Nekrutenko, KD Makova (2014) Proceedings of the National Academy of Sciences, 11, 15474-15479
 17. Development and assessment of an optimized next-generation DNA sequencing approach for the mtgenome using the Illumina MiSeq. J McElhoe, **M Holland**, K Makova, MS-W Su, I Paul, C Baker, S Faith, B Young (2014) Forensic Science International: Genetics, 13, 20-29
 18. Forensic Aspects of mtDNA Analysis. **MM Holland**, G Lauc (2014) Forensic DNA Applications: An Interdisciplinary Perspective; CRC Press, Taylor & Francis Group, Editors Dragan Primorac and Moses Schanfield, 85-104
 19. Forensic mitochondrial DNA analysis: current practices and future potential. **M Holland**, T Melton, C Holland (2013) Forensic DNA Analysis, Current Practices and

Emerging Technologies; CRC Press, Editor Jaiprakash G. Shewale and Co-Editor Ray H. Liu, 249-278

20. A cautionary note on switching mitochondrial DNA reference sequence in forensic genetics. A Salas, M Coble, S Desmyter, T Grzbowski, L Gusmão, C Hohoff, **MM Holland**, et al. (2012) Forensic Science International: Genetics, 6, e182-184
21. Molecular analysis of the human mitochondrial DNA control region for forensic identity testing. **MM Holland** (2012) Curr Protoc Hum Genet, Chapter 14:Unit 14.7
22. Forensic mitochondrial DNA analysis: current practices and future potentials. T Melton, C Holland, **M Holland** (2012) Forensic Science Review, 24, 101-122
23. Second generation sequencing allows for mtDNA mixture deconvolution and high resolution detection of heteroplasmy. **MM Holland**, M McQuillan, KA O’Hanlon (2011) Croatian Medical Journal, 52, 299-313
24. GeneMarker® HID: a reliable software tool for the analysis of forensic STR data. **M Holland**, W Parson (2011) J For Sci, 56(1), 29-35
25. Development of a quality, high throughput DNA analysis procedure for skeletal samples to assist with the identification of victims from the world trade center attacks. **MM Holland**, CA Cave, CA Holland, TW Bille (2003) Croatian Medical Journal, 44(3), 264-272
26. A new database of mitochondrial DNA hypervariable region 1 and 2 sequences from 162 Japanese individuals. K Imaizumi, TJ Parsons, M Yoshihno, **MM Holland** (2002) International Journal of Legal Medicine, 116 (2), 68-73
27. Improved mtDNA sequence analysis of forensic remains using a “mini-primer set” amplification strategy. MN Gabriel, EF Huffine, JH Ryan, **MM Holland**, TJ Parsons (2001) J For Sci, 46(2), 247-253
28. Human hair histogenesis for the mitochondrial DNA forensic scientist. CA Linch, DA Whiting, **MM Holland** (2001) J For Sci, 46(4), 844-853
29. Multiplex PCR amplification of eight STR loci in Austrian and Croatian Caucasian populations. J Ross, W Parson, I Furac, M Kubat, **M Holland** (2001) International Journal of Legal Medicine, 115, 57-60
30. Molecular analysis of the human mitochondrial DNA control region for forensic identity testing. **MM Holland**, EF Huffine (2001) Curr Protoc Hum Genet, Chapter 14:Unit 14.7
31. Isolation of DNA from Forensic Evidence. DH Bing, FR Bieber, **MM Holland**, EF

Huffine (2001) Curr Protoc Hum Genet, Chapter X: Unit Y

32. A sensitive denaturing gradient-gel electrophoresis assay reveals a high frequency of heteroplasmy in hypervariable region I of the human mtDNA control region. LA Tully, TJ Parsons, RJ Steighner, **MM Holland**, MA Marino, VL Prenger (2000) American Journal of Human Genetics, 67(2), 432-443
33. DNA Commission of the International Society for Forensic Genetics: guidelines for mitochondrial DNA typing. A Carracedo, W Bar, P Lincoln, W Mayr, N Morling, B Olaisen, P Schneider, B Budowle, B Brinkmann, P Gill, **M Holland**, G Tully, M Wilson (2000) Forensic Science International, 110(2), 79-85
34. Mitochondrial DNA sequence analysis – validation and use for forensic casework. **MM Holland**, TJ Parsons (1999) Forensic Science Review, 11, 21-50
35. Comparative identity and homogeneity testing of the mtDNA HV1 region using denaturing gradient gel electrophoresis. RJ Steighner, LA Tully, JD Karjala, MD Coble, **MM Holland** (1999) J For Sci, 44(6), 1186-1198
36. Expanding the forensic German Mitochondrial DNA control region database: genetic diversity as a function of sample size and microgeography. H Pfeiffer, B Brinkmann, J Hühne, B Rolf, AA Morris, R Steighner, **MM Holland**, P Forster (1999) International Journal of Legal Medicine, 112, 291-298
37. The use of DNA analysis in the identification and re-association of remains recovered from TWA Flight 800 and KAL Flight 801. DA Lee, JM Willard, JP Ross, DE Katz, **MM Holland** (1999) The 6th Indo Pacific Congress on Legal Medicine and Forensic Sciences, INPALMS-1998-KOBE, Yoshitsugu Tatsuno (ed.), 249-252
38. A validation study for the extraction and analysis of DNA from human nail material and its application to forensic casework. TD Anderson, JP Ross, DA Lee, RK Roby, JJ Canik, **MM Holland** (1999) J For Sci, 44(5), 1053-1056
39. Mitochondrial DNA regions HVI and HVII population data. B Budowle, MR Wilson, JA DiZinno, C Stauffer, MA Fasano, **MM Holland**, KL Monson (1999) Forensic Science International, 103, 23-35
40. Mitochondrial DNA extraction and typing from isolated dentin – experimental evaluation in a Korean population. H Pfeiffer, R Steighner, R. Fisher, H Mörnstad, C-L Yoon, **MM Holland** (1998) The International Journal of Legal Medicine, 111, 309-313
41. Population data for 101 Austrian Caucasian mitochondrial D-Loop sequences: application of MtDNA sequence analysis to a forensic case. W Parson, TJ Parsons, R Scheithauer, **MM Holland** (1998) The International Journal of Legal Medicine, 111,

42. Recovery of DNA for PCR amplification from blood and forensic samples using a chelating resin. JM Willard, DA Lee, **MM Holland** (1998) Methods in Molecular Biology: Forensic DNA Profiling Protocols, 98, 9-18
43. Amplification and sequencing of Mitochondrial DNA in forensic casework. RJ Steighner, **MM Holland** (1998) Methods in Molecular Biology: Forensic DNA Profiling Protocols, 98, 213-224
44. A high observed substitution rate in the human mitochondrial DNA control region. TJ Parsons, DS Muniec, K Sullivan, N Woodyatt, R Alliston-Greiner, MR Wilson, DL Berry, KA Holland, VW Weedn, P Gill, **MM Holland** (1997) Nature Genetics, 15, 363-368
45. Multiplex systems for the amplification of short tandem repeat loci: evaluation of laser fluorescence detection. MD Ricciardone, AM Lins, JW Schumm, **MM Holland** (1997) Biotechniques, 23, 742-747
46. DNA analysis. VW Weedn, DA Lee, RK Roby, **MM Holland** (1997) Analytical Therapeutic Drug Monitoring and Toxicology, SHY Wong and I Sunshine (eds.), CRC Press, 35-50
47. Mitochondrial DNA sequence heteroplasmy in the Grand Duke of Russia Georgij Romanov establishes the authenticity of the remains of Tsar Nicholas II. PL Ivanov, MJ Wadhams, RK Roby, **MM Holland**, VW Weedn, TJ Parsons (1996) Nature Genetics, 12, 417-420
48. Establishing the identity of Anna Anderson Manahan. M Stoneking, T Melton, J Nott, S Barritt, R Roby, **M Holland**, V Weedn, P Gill, C Kimpton, R Aliston-Greiner, K Sullivan (1995) Nature Genetics, 9(1), 9-10
49. DNA and the forensic odontologist. BC Smith, **MM Holland**, DL Sweet, JA DiZinno (1995) The Manual of Forensic Odontology, American Society of Forensic Odontology, CM Bowers and GL Bell (eds.), 283-298
50. Serological and DNA methods for the identification of urine specimen donors. **MM Holland**, R Roy, MD Fraser (1995) The Handbook of Workplace Drug Testing, RH Liu and BA Goldberger (eds.), 159-180
51. Further validation of the Quad 1 STR DNA typing system: a collaborative effort to identify victims of a mass disaster. TM Clayton, DL Fisher, **MM Holland**, DA Lee, CN Maguire, VW Weedn, JP Whitaker, P Gill (1995) Forensic Science International, 76, 17-25

52. Mitochondrial DNA sequence analysis of human remains. **MM Holland**, DL Fisher, RK Roby, J Ruderman, C Bryson, VW Weedn (1995) Crime Laboratory Digest, 22(4), 3-8
53. Identification of human remains using mitochondrial DNA sequencing: potential mother-child mutational events. **MM Holland**, RK Roby, DL Fisher, J Ruderman, DA Lee, CK Bryson, T Kupferschmid, RS Loft, AJ Eisenberg (1994) Advances in Forensic Haemogenetics, W Bär, A Fiori and U Rossi (eds.), 399-406
54. Typing human DNA using capillary electrophoresis: comparison of slab gel and capillary formats. **MM Holland**, LA Turni, S Delrio, M Marino, RS Lofts, DL Fisher, J Ross, JW Schumm, PL Williams (1994) Advances in Forensic Haemogenetics, W Bär, A Fiori and U Rossi (eds.), 156-159
55. Mitochondrial DNA sequence analysis of human skeletal remains: identification of remains from the Vietnam War. **MM Holland**, DL Fisher, LG Mitchell, WC Rodriguez, JJ Canik, CR Merril, VW Weedn (1993) J For Sci, 38(3), 542-553
56. Extraction, evaluation, and amplification of DNA from decalcified and undecalcified United States Civil War bone. DL Fisher, **MM Holland**, L Mitchell, PS Sledzik, AW Wilcox, M Wadhams, VW Weedn (1993) J For Sci, 38(1), 60-68
57. A systematic approach to the sampling of dental DNA. BS Smith, VW Weedn, GR Warnock, **MM Holland** (1993) J For Sci (Technical Note), 38(5), 1194-1209
58. Guidelines for the use of mitochondrial DNA sequencing in forensic science, MR Wilson, **MM Holland**, M Stoneking, JA DiZinno, B Budowle (1993) Crime Laboratory Digest, 20(4), 68-77
59. Short tandem repeat loci: application to forensic and human remains identification. **MM Holland**, DL Fisher, DA Lee, CK Bryson, VW Weedn (1993) The Second International Conference on DNA Fingerprinting, DNA Fingerprinting: State of the Science, SDJ Pena, R Chakraborty, JT Epplen, and AJ Jeffreys (eds.), 267-274
60. Application of serological and DNA methods for identification of urine specimen donors. **MM Holland**, R Roy, MD Fraser, RH Liu (1993) Forensic Science Review, 5(1), 1-14
61. Programmed demethylation in CpG islands during human fetal development. BR Migeon, **MM Holland**, DJ Driscoll, JC Robinson (1991) Somatic Cell and Molecular Genetics, 17(2), 159-168
62. Isolation and characterization of a small catalytic domain released from the Adenylate Cyclase from *Escherichia coli* by digestion with trypsin. **MM Holland**, TK Leib, JA Gerlt (1988) The Journal of Biological Chemistry, 263, 14661-14668

Government Research Reports:

1. Using Technology to Assist Medical Examiners and Coroners in the Identification of Human Remains, National Center for Forensic Science, National Institute of Justice, Department of Justice, January 2009
2. Mass Fatality Incidents: A Guide for Human Forensic Identification, National Institute of Justice, Department of Justice, June 2005
3. Forensic Laboratories: Handbook for Facility Planning, Design, Construction, and Moving, National Institute of Standards and Technology, National Institute of Justice, Department of Justice, April 1998