Forensic DNA Mixture Interpretation

MAFS Workshop
Milwaukee, WI
September 25, 2012

Dr. John M. Butler &
Dr. Michael D. Coble
National Institute of
Standards and Technology

john.butler@nist.gov
michael.coble@nist.gov
Forensic DNA Mixture Interpretation

Introductions

MAFS Workshop
Milwaukee, WI
September 25, 2012

Dr. John M. Butler &
Dr. Michael D. Coble
National Institute of
Standards and Technology

john.butler@nist.gov
michael.coble@nist.gov
Outline for Today’s Workshop

• Introductions (*John, Mike & each of you!*)

• Mixture Fundamentals & Literature Review (*John*)

BREAK

• Statistical Approaches for Mixtures (*Mike*)

LUNCH BREAK

• Thresholds & Low Level Mixtures (*John*)

BREAK

• Probabilistic Genotyping & Software (*Mike*)
Dr. John M. Butler

http://www.cstl.nist.gov/biotech/strbase/butler.htm

Experience

• University of Virginia/FBI Laboratory (1992-1995)
  – Work performed in Bruce McCord’s lab
• NIST NRC Postdoc (1995-1997)
• NIST Human Identity Project Leader (1999-present)

• *Forensic DNA Typing* textbook (now in its 2nd Edition)
• STRBase website: http://www.cstl.nist.gov/biotech/strbase/
• Family: wife Terilynne and 6 children
• Hobbies: reading, writing, and making PowerPoint slides

Contact Information
john.butler@nist.gov
301-975-4049
Dr. Michael D. Coble


Experience

  – Work performed with Tom Parsons
• NIST NRC Postdoc (2004-2006)
• AFDIL Research Section Chief (2006-2010)
• NIST Applied Genetics Group (2010-present)

• Family: wife Karen and 3 children
• Hobbies: Fantasy baseball and football team owner

Contact Information
michael.coble@nist.gov
301-975-4330
NIST History and Mission

- National Institute of Standards and Technology (NIST) was created in 1901 as the National Bureau of Standards (NBS). The name was changed to NIST in 1988.

- NIST is a non-regulatory agency within the U.S. Department of Commerce with a mission to develop and promote measurement, standards, and technology to enhance productivity, facilitate trade, and improve the quality of life.

- NIST supplies over 1,300 Standard Reference Materials (SRMs) for industry, academia, and government use in calibration of measurements.

- NIST defines time for the U.S.
NIST Gaithersburg Campus

Located in Gaithersburg, Maryland, on approximately 234 hectares (578 acres) just off Interstate 270 about 25 miles northwest of Washington, D.C.

http://www.nist.gov

~2,500 staff
Bringing calibration to clinical DNA diagnostics, speed to DNA testing, and technology to the scales of justice
APPLIED GENETICS Group

Major Programs Currently Underway

• Forensic DNA
  – STRBase website
  – New loci and assays (26plex)
  – **STR kit concordance & new autosomal STR loci**
  – Ancestry SNP assays
  – Low-template DNA studies
  – **Mixture interpretation research and training**
  – Variant allele cataloging and sequencing
  – ABI 3500 validation
  – Training workshops to forensic DNA laboratories
  – **Y-STR markers**
  – Validation experiments, information and software tools
  – **Textbooks – 3rd ed.** (3 volumes)

• Clinical Genetics
  – Huntington’s Disease SRM
  – CMV SRM
  – Exploring future needs

• Ag Biotech
  – “universal” GMO detection/quantitation (35S promoter)

• DNA Biometrics
  – **Rapid PCR methods**
  – Efforts to standardize testing of future portable DNA systems
  – Kinship analysis

• **Cell Line Authentication**
  – ATCC documentary standard
NIST Human Identity Project Teams
within the Applied Genetics Group

**Forensic DNA Team**

Funding from the National Institute of Justice (NIJ) through NIST Office of Law Enforcement Standards

John Butler  
Mike Coble  
Becky Hill  
Margaret Kline

**DNA Biometrics Team**

Funding from the FBI S&T Branch through NIST Information Access Division

Pete Vallone  
Erica Butts  
Kevin Kiesler

**Guest Researcher**

Returned to Spain in July 2012

Manuel Fondevila Alvarez

**Data Analysis Support**

Concordance & LT-DNA  
SRM work, variant alleles & Cell Line ID  
Mixtures, mtDNA & Y

Office Manager  
Patti Rohmiller

Dave Duewer

STRBase, Workshops & Textbooks  
Rapid PCR, Direct PCR & Biometrics  
Plex-ID & NGS Exploration

ABI 3500 & DNA Extraction  
Variant alleles & Cell Line ID

http://www.cstl.nist.gov/biotech/strbase/NISTpub.htm
Forensic DNA Typing Textbook

3rd Edition is Three Volumes

Now part of my job at NIST (no royalties are received)

For beginning students, general public, & lawyers

**Fundamentals of Forensic DNA Typing**
- Sept 2009
- ~500 pages

**Advanced Topics in Forensic DNA Typing: Methodology**
- August 2011
- ~700 pages

**Advanced Topics in Forensic DNA Typing: Interpretation**
- Fall 2013
- ~500 pages

Currently being written
MAFS 2012 Mixture Workshop Registrants

20 states

60 people
- 53 state or local lab
- 2 AFDIL
- 2 lawyers
- 1 university
- 1 private lab
- 1 NIST

Green = participants
Gray = no attendees
Understanding the Audience Here

Name, Laboratory, what you hope to learn in workshop

• Where is everyone from?
  – State lab?
  – Local lab?
  – Private lab?

• Experience level?
  – Less than 1 year?
  – 1-3 years?
  – >3 years?

• STR kits in use?
  – Profiler Plus/COfiler
  – Identifiler (Direct, Plus)
  – PowerPlex 16 (HS)
  – Y-STRs?

• Instrumentation is use?
  – ABI 310
  – ABI 3100/3130/3130xl
  – ABI 3500/3500xl

• Software in use?
  – GeneMapperID
  – GeneMapperID-X
  – Other?

Benefits of this exercise:
1) We can tailor remarks to your interests and needs
2) You feel more comfortable asking questions and being involved when you know others
Contributors to These Workshop Slides

Becky Hill  
NIST

Erica Butts  
NIST

Bruce McCord  
Florida International University

Robin Cotton  
Boston University

Catherine Grgicak  
Boston University

Charlotte Word  
Consultant

STRs  
ABI 3500

CE  
Mixture Interpretation
2010-2012 Mixture Workshop Attendees

49 states and 25 other countries

Green = participants
Gray = no attendees

4 regional workshops

Federal Labs
FBI
ATF
AFDIL
USACIL

Algeria
Argentina
Bahamas
Belgium
Brazil
Canada
Croatia
Finland
France
Israel
Italy
Jamaica
Japan
Korea
Mexico
Netherlands
New Zealand
Panama
Peru
Russia
Saudi Arabia
Singapore
Spain
Switzerland
UK

Alaska
Hawaii
Puerto Rico
STRBase Mixture Section

- [http://www.cstl.nist.gov/strbase/mixture.htm](http://www.cstl.nist.gov/strbase/mixture.htm)

- Slides from various mixture workshops
- SWGDAM Mixture Committee Resource Page
  - [http://www.swgdam.org/resources.html](http://www.swgdam.org/resources.html)
- Information and links to mixture software
- Literature listing by topic
NIST and NIJ Disclaimer

**Funding**: Interagency Agreement 2010-DN-R-7121 between the National Institute of Justice and NIST Office of Law Enforcement Standards

**Points of view are the presenters** and do not necessarily represent the official position or policies of the US Department of Justice or the National Institute of Standards and Technology.

Certain commercial equipment, instruments and materials are identified in order to specify experimental procedures as completely as possible. In no case does such identification imply a recommendation or endorsement by the National Institute of Standards and Technology nor does it imply that any of the materials, instruments or equipment identified are necessarily the best available for the purpose.

SWGDAM and FBI CODIS Loci WG Disclaimer...
Now on with the workshop…

Our team publications and presentations are available at:
http://www.cstl.nist.gov/biotech/strbase/NISTpub.htm

Funding from the National Institute of Justice (NIJ) through NIST Office of Law Enforcement Standards

Questions?

john.butler@nist.gov
301-975-4049

michael.coble@nist.gov
301-975-4330