

**National Quality Assurance Institute
of Standards and Technology**

NIST Update

 John M. Butler

 SWGDAM
 January 11, 2007

Standard 1. Scope

Scope of Our Work

- The NIST Human Identity Project Team is trying **to lead the way in forensic DNA...** through research that helps bring traceability and technology to the scales of justice.

Standard 2. Definitions

NIST and NIJ Disclaimer

Funding: Interagency Agreement 2003-IJ-R-029 between the **National Institute of Justice** and NIST Office of Law Enforcement Standards

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

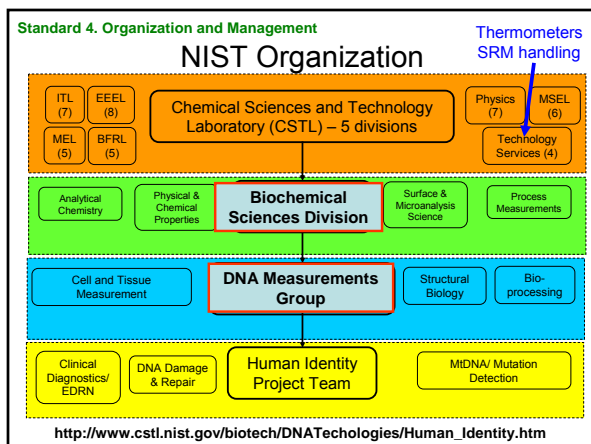
Certain commercial equipment, instruments and materials are identified in order to specify experimental procedures as completely as possible. In no case does such identification imply a recommendation or endorsement by the National Institute of Standards and Technology nor does it imply that any of the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

Standard 3. Quality Assurance RESEARCH Program

Current Areas of NIST Effort with Forensic DNA

- **Standards**
 - Standard Reference Materials
 - Standard Information Resources (STRBase website)
 - Interlaboratory Studies
- **Technology**
 - Research programs in SNPs, miniSTRs, Y-STRs, mtDNA, qPCR
 - Assay and software development, expert system review
- **Training Materials**
 - Review articles and workshops on STRs, CE, validation
 - PowerPoint and pdf files available for download

<http://www.cstl.nist.gov/biotech/strbase/NIJprojects.htm>



Standard 5. Personnel

NIST Human Identity Project Team

>85 years experience in scientific research


John Butler **Margaret Kline** **Jan Redman** **Pete Vallone** **Becky Hill** **Amy Decker** **Dave Duerer**

Former Project Team Members

Mike Coble **Chris DeAngelis** **Jill Appleby** **Rich Schoske** **Christian Ruitberg** **Dennis Reeder**

AFDIL **Medical School** **NC SBI** **Air Force** **Pharma** **Retired/ABI**

Standard 5. Personnel **Team Impact**




- **26 publications** since Jan 2006
- **45 presentations** and **10 workshops** to the community since Jan 2006
- **Training workshops:** AAFS, MAAFS, MAFS, OCME, MASP, NYSP, MN BCA (slides available on STRBase)
- **PDI Workshops:** Validation, mtDNA, qPCR

All NIST publications and presentations available on STRBase:
<http://www.cstl.nist.gov/biotech/strbase/NISTpub.htm>

Standard 5.1.2.1 Training Manual **On STRBase...**

<http://www.cstl.nist.gov/biotech/strbase/training.htm>



STR Training Materials

PowerPoint slides for figures from *Forensic DNA Typing* (2nd Edition) [181 slides, 8.72 Mb file]

NIST STR Section Training Manual (2.5 Mb pdf file for the Massena State Highway Patrol Forensic Laboratory - an example of information height, regional reading and operations, for DNA analysis and techniques in training - provided by *Paul Monaghan* of the Massena State Highway Patrol Crime Laboratory)

PowerPoint Presentations and Slide Shows

- Background Information (20 slides)
- STR Technology (13 slides)
- LCN/mtDNA/STRs (40 slides)
- From lab given by John Butler at Cambridge Healthtech Institute's Fourth Annual DNA Forensics Meeting, June 1, 2000
- *STR 2002*, July (23 slides)
- given by John Butler at 19th Congress of the International Society of Forensic Genetics (Munster, Germany) August 30, 2001
- Training on STR Typing Using Commercial Kits and ABI 3100/3100i *Part 1* (48 slides) *Part 2* (48 slides)
- Margaret C. Klein, Jarett W. Beckman, John M. Butler October 22-26, 2003
- John Butler and Bruce McCord workshop at the American Academy of Forensic Sciences (Seattle, WA), February 20, 2006
 - STR Biology, Methods, and Methods (09 slides, 5.4 Mb file)
 - Changing Electrophoresis Instrumentation, Theory and Applications (71 slides, 5.4 Mb)
 - Y-STRs: A Genetic Tool for Identifying a Male "Suspect" (91 slides, 9.1 Mb)
 - CE Troubleshooting (77 slides, 5.9 Mb)
 - STR Mutations Interpretation (46 slides, 2.1 Mb)
 - STR Comparisons with Real-time qPCR and Amp-Flap/Flap/Flap (63 slides, 3.8 Mb)
 - STRs and mtDNA (17 slides, 1.8 Mb)

Standard 5.1.3.1 Training **Training Workshops Conducted**

<http://www.cstl.nist.gov/biotech/strbase/training.htm>

John Butler (and Bruce McCord, Robyn Ragsdale, Pete Vallone, or Mike Coble)



Sept 29-30, 2004
Nov 1-2, 2006

May 3, 2006

October 11, 2006

May 19, 2005

June 8, 2005

June 6, 2006

August 7, 2006

Dec 5-6, 2006

February 20, 2006

June 13-14, 2005

April 27-28, 2006

May 10, 2006

August 24-26, 2005

March 13-15, 2006

July 26-27, 2006

April 4, 2006

August 17, 2006

Standard 5.1.3.1 Training

Workshops Conducted This Past Year

- **qPCR workshop** by Vallone and Orrego (July 2006) – slides available on STRBase
 – <http://www.cstl.nist.gov/biotech/strbase/qPCRworkshop.htm>
- **LCN workshop** by Butler, Caragine, and Gill (May 2006) – Butler slides available on STRBase
 – <http://www.cstl.nist.gov/biotech/strbase/training.htm>
- **Y-STR and mtDNA workshop** by Butler and Coble (Nov 2006) – >600 slides available on STRBase
 – <http://www.cstl.nist.gov/biotech/strbase/YmtDNAworkshop.htm>

Standard 5.1.3.2 Review of Scientific Literature

Analytical Chemistry Review Article

- Will review ~300 articles published in 2005-2006 covering virtually every topic in forensic DNA analysis
- Due to be published June 15, 2007

Forensic Science June 15, 2005 issue of *Anal. Chem.*

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Standard 5.1.3.2 Review of Scientific Literature



Standard 5.1.3.2 Review of Scientific Literature

Forensic Science International: Genetics

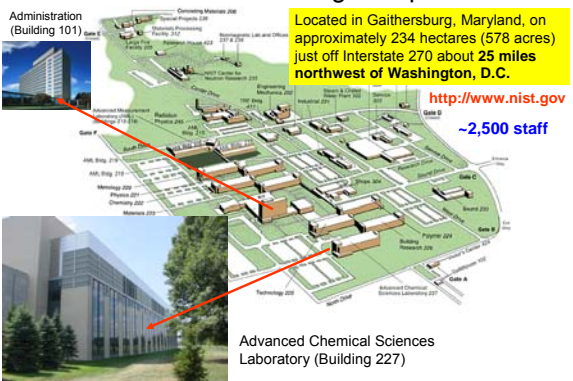


Editor-in-Chief:
Angel Carracedo (Spain)
Associate Editors:
Peter M. Schneider (Germany)
John M. Butler (USA)

FSI: Genetics is a new journal dedicated exclusively to the field of forensic genetics. It has been launched in 2007 by Elsevier Publishers in affiliation with the International Society of Forensic Genetics. **All members of the ISFG receive a free subscription of this journal** (print and online version) as part of their membership benefits.

Standard 6. Facilities

NIST Gaithersburg Campus



Administration (Building 101)

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

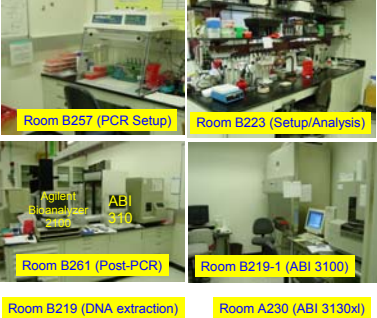
<http://www.nist.gov>

~2,500 staff

Advanced Chemical Sciences Laboratory (Building 227)

Standard 6. Facilities

NIST Human Identity Project Team Laboratory Space (within Building 227)



Equipment List

- GeneAmp 9700 (3)
- GeneAmp 9600
- ABI 310
- ABI 3100
- ABI 3130xl
- FMBIO III+
- ABI 7500 real-time PCR
- ABI 7000
- Agilent Bioanalyzer 2100
- Varian UV spec
- Varian HPLC
- Bruker TOF-MS
- Corbet robot
- 80 °C freezers

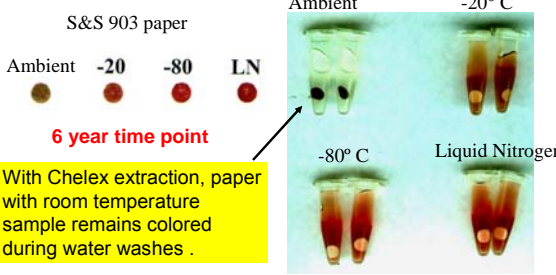
Room B257 (PCR Setup) Room B223 (Setup/Analysis)

Room B261 (Post-PCR) Room B219 (DNA extraction)

Room B219 (DNA extraction) Room A230 (ABI 3130xl)

Standard 7. Evidence Control

On-going DNA Storage and Stability Studies Are Being Conducted



S&S 903 paper

Ambient -20 -80 LN

6 year time point

Ambient -20° C

-80° C Liquid Nitrogen


With Chelex extraction, paper with room temperature sample remains colored during water washes .

<http://www.cstl.nist.gov/biotech/strbase/NIJ/DNArecovery.htm>

Standard 8. Validation

Validation Information

- President's DNA Initiative: **Validation Workshop (Aug 2005) with Robyn Ragsdale** – slides on STRBase; NFSTC working on DVD
- ABI Roadshow/HID University: Validation Workshop (May 2006)** – slides available on STRBase
- We would love to have **more internal validation information for STRBase Validation Section** (e.g., Y-STRs)



Profiles in DNA (Promega Corporation), vol. 9(2), pp. 3-6 PROFILES IN DNA

VALIDATION

http://www.promega.com/profiles/902/ProfilesInDNA_902_03.pdf

Debunking Some Urban Legends Surrounding Validation Within the Forensic DNA Community

By John Butler
National Institute of Standards and Technology, Gaithersburg, Maryland, USA

Standard 9.5.5 Available NIST SRMs

Standard Reference Materials


- Relevant Forensic DNA SRMs
 - SRM 2391b (DNA profiling – STRs, D1S80, DQA1/PM)
 - SRM 2392-I (mtDNA)
 - SRM 2395 (Y-chromosome)
 - SRM 2372 (Human DNA quantitation); **in development**
- Provides national/international traceability and compatibility (aids in ISO 17025 compliance)

<http://www.nist.gov/srm>

Standard 9.5.5 Available NIST SRMs

NIST SRM 2372

Human DNA Quantitation Standard



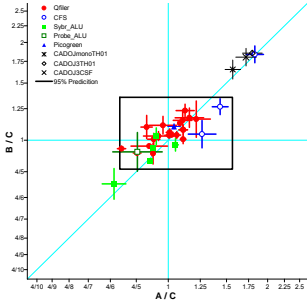
Components
 A: Male/single donor/RNased/NIST
 B: Female/multiple donors/NIST
 C: Mixture/male & female/commercial

Quantities
 110 µL of Human Genomic DNA
 Absorbance of 1.0 OD
 Conventional [DNA] 50 ng/µL.

Certification
 Absorbance by US National Spectrophotometer
 Homogeneity by Cary 100 Bio
Validation of conventional [DNA] by Interlaboratory Study

Standard 9.5.5 Available NIST SRMs

SRM 2372 Interlaboratory Data



32 laboratories participated
Preliminary results are shown for the qPCR data.

Each laboratory's data has been summarized to a single point per type of assay. Error bars are included. The comparisons are the differences between A to C, and B to C.

The box represents the 95% confidence interval.

Standard 9.5.5 Available NIST SRMs

Preparation of SRM 2372 Materials



Standard 9.5.5 Available NIST SRMs

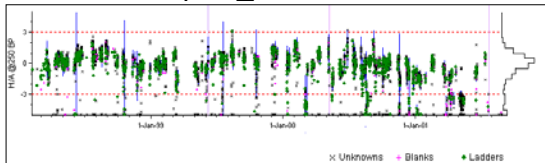
Status of SRM 2372

- **The three components have been bottled** – we prepared 1,700 units (there is a great deal of interest in SRM 2372 outside of the forensic community—e.g., pharmaceutical industry)
- **Studies performed:**
 - Interlab study of performance (32 forensic labs)
 - homogeneity (monitored by NIST statisticians)
 - measurement on the NIST National-Reference Spectrophotometer
- **Currently completing documentation:** Report of Analysis, Certificate with certified values, scientific paper, **AAFS 2007 talk**

We hope to release this SRM in March 2007

Standard 10. Equipment Calibration

Multiplex_QA Overview



- **Research tool** that provides quality metrics to review instrument performance over time (e.g., examines resolution on internal size standard peaks)
- Runs with Microsoft Excel macros. Requires STR data to be converted with NCBI's BatchExtract program into numerical form.

Available for download from STRBase:
<http://www.cstl.nist.gov/biotech/strbase/software.htm>

Standard 10. Equipment Calibration

Multiplex_QA Article Published

Electrophoresis 2006, 27, 3735-3746 October 2006 issue of *Electrophoresis* 3735

David L. Dummer¹
 John M. Butler²

Research Article

Multiplex_QA: An exploratory quality assessment tool for multiplexed electrophoretic assays

Multiplex_QA is a data analysis tool for visualizing short- and long-term changes in the performance of multiplexed electrophoretic assays, particularly the commercial short tandem repeat (STR) kits used by the human forensic identity community. A number of quality metrics are calculated from the signal collected for the internal size standard included in nearly all multiplex assays. These quality metrics are related to the signal intensity, symmetry, retention, resolution, and noise of data collected by capillary electrophoresis systems. Interlocking graphical displays enable the identification of changes in the quality metrics with time, evaluation of relationships among the metrics, and detailed examination of electrophoretographic features of particularly interesting analyses. While primarily intended for exploring which metrics are most useful for documenting data quality, the current version of the tool is sufficiently robust for use by forensic scientists with an interest in data analysis and access to a fast desktop computer.

Received March 3, 2006
 Revised April 21, 2006
 Accepted May 11, 2006

Keywords: Electrophoresis / Exploratory data analysis / Quality assessment / Resolution DOI 10.1002/elps.200600116

User manual (127 pages) available for download from STRBase

Thank you for your attention...

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

Questions?



See also <http://www.dna.gov/research/nist>
<http://www.cstl.nist.gov/biotech/strbase>
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