FORENSICS@NIST
November 28-30, 2012 • #NISTForensics

STRBase and Information Resources on Forensic DNA

John M. Butler

NIST Fellow & Applied Genetics Group Leader

Forensics@NIST 2012 Meeting
Gaithersburg, MD
November 28, 2012

NIST Applied Genetics

Information Gathering and Sharing

- **We live in the information age and need to share what we learn as scientists with others**
- Sharing information impacts validation of techniques, which impact court use of the technique
- DNA is often referred to as the “gold standard” in forensic science because of the scientific studies performed and information sharing that has occurred
- **You need a good library (information collection) to be successful in developing any scientific discipline**
- Knowing the literature provides a solid foundation for research and future work

Presentation Outline

Information Input

- Information gathering efforts within our group
- Forensic DNA literature
- Meetings where we learn from others (& present)

Information Output

- STRBase website – its origin and content
- Training workshops
- *Forensic DNA Typing* textbooks

Committee contributions

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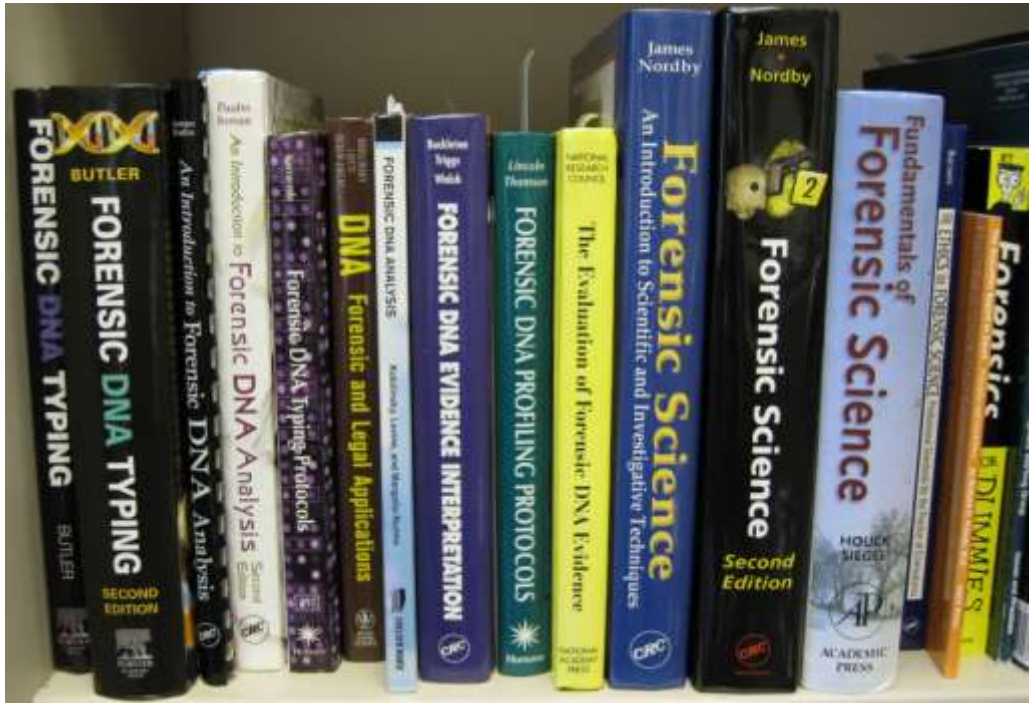
Forensic DNA Library

Books Located in 227/B250 and B224

Have purchased >300 books on topics related to forensic DNA analysis as of November 2012



Initially funded from 2002-2007 by PECASE award money

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Collection of Journals in Our Group Library

We now have on-line access to all forensic DNA journals

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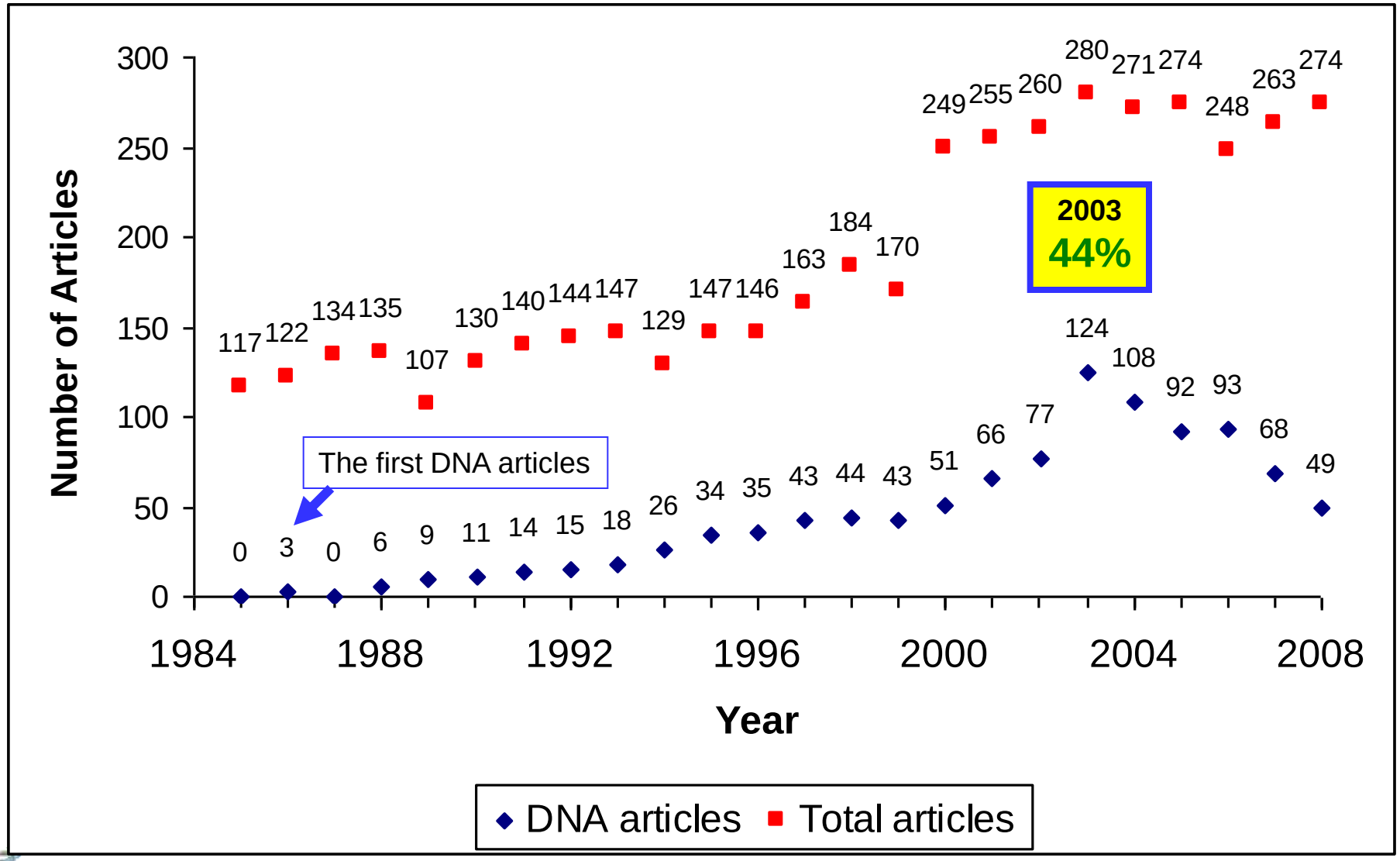
Journal of Forensic Sciences

DNA publications vs total articles



From PubMed searches performed Feb 2009 using http://www.ncbi.nlm.nih.gov/sites/entrez

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Forensic Science Publications

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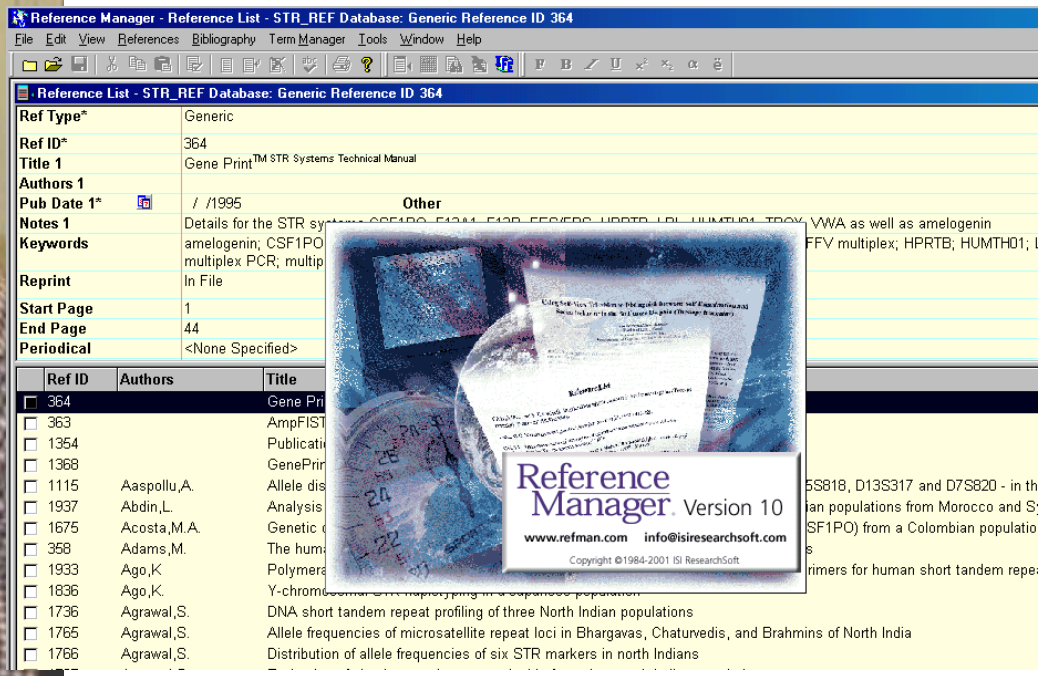
Our Project Team Library

>9,000 references
gathered and cataloged in Reference Manager

- Started by Christian Ruitberg
- Maintained now by **John Butler**
- **Updated regularly** and provided to NIST Human Identity Project Team



Comprehensive set of forensic DNA articles

We Attend & Contribute Each Year to Numerous Scientific Meetings

AAFS

International Society of Forensic Genetics

SWGDAM

National CODIS Conference

AAFS 2009 Topics Regarding Forensic DNA

From abstracts of presentations at AAFS meeting in Denver, CO (Feb 2009)

- Improved DNA extraction
- Predicting hair color and ancestry with SNPs
- X-chromosome STRs
- **Familial searching**
- Y-STRs and mixtures
- **Low level DNA samples**
- miniSTRs
- DNA screening assays
- Optimizing database labs
- Microfluidic biochip systems
- Use with property crimes
- Recovery from handguns
- DNA from IEDs
- Expert systems
- Automation with robotics
- DNA quantitation – qPCR
- PCR directly from blood
- mtDNA
- RNA
- Non-human DNA (dogs & cows)
- **Mixture interpretation**

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Collection of Notes from Meetings Attended

Detailed notes are taken at every meeting we attend and shared with the group when we return to NIST
(presentations are made to our group at the next group meeting)

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Good information input improves output…

Some Fruits of a Good Literature Collection

Review Articles

J Forensic Sci, March 2006, Vol. 51, No. 2
doi:10.1111/j.1556-4029.2006.00046.x
Available online at: www.blackwell-synergy.com

John M. Butler,[1] *Ph.D.*

Genetics and Genomics of Core Short Tandem Repeat Loci Used in Human Identity Testing

Anal. Chem. **2007**, *79*, 4365−4384

Analytical Chemistry **(June 15, 2007 issue)**

Forensic Science

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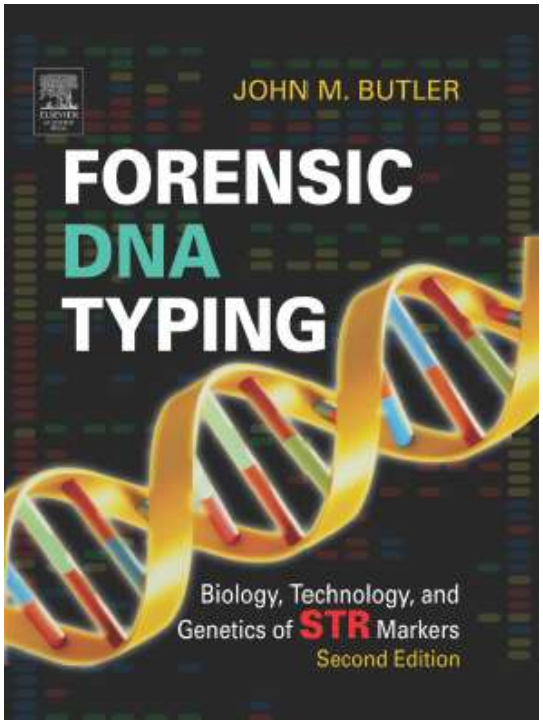
Textbooks



2nd Edition 688 pp.
Feb 2005

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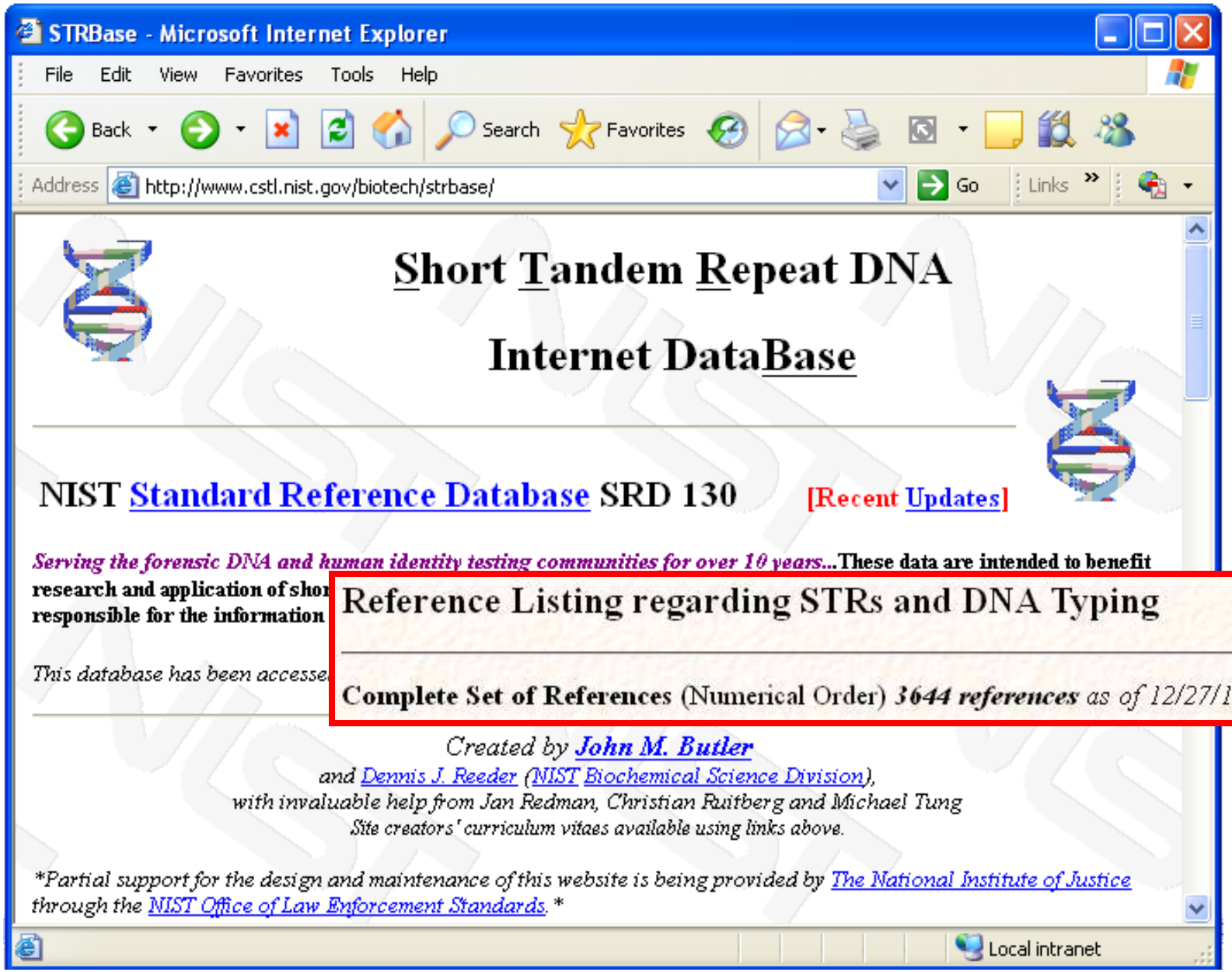
And a Useful Reference Website…



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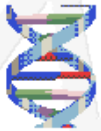
NIST **STRBase** Website

Serving the Forensic DNA Community for >15 Years



Short Tandem Repeat DNA

Internet DataBase

NIST Standard Reference Database SRD 130 [Recent Updates]

Serving the forensic DNA and human identity testing communities for over 10 years... These data are intended to benefit research and application of short tandem repeat DNA markers to human identity testing. The authors are solely responsible for the information herein.
Please Rate Our Products and Services: http://tsapps.nist.gov/MSDSurvey/default.aspx?ID=5&DB=130

This database has been accessed 458551 *times since 10/02/97.* (Counter courtesy www.digits.com - see disclaimer)

Created by ***John M. Butler***
and Dennis J. Reeder (NIST Biochemical Science Division),
with invaluable help from Jan Redman, Christian Ruitberg and Michael Tung
Site creators' curriculum vitaes available using links above.

Partial support for the design and maintenance of this website is being provided by The National Institute of Justice through the NIST Office of Law Enforcement Standards.

General Information

- Purpose of STRBase/NAR 2001 Paper describing STRBase/Overview Presentation
- Publications and Presentations from NIST Human Identity Project Team
- NIJ-Funded Projects
- Training Materials
- Links to other web sites
- Glossary of commonly used terms

http://www.cstl.nist.gov/strbase/

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A Brief History of the STRBase Website

- Initial information was collected on STR markers while working on my PhD dissertation in 1993-1995
- Started a review article in 1996 while a NIST postdoc but wanted to create a dynamic rather than an out-of-date resource
- Created hundreds of individual web pages that were hyperlinked together
- Website launched in July 1997
- Became a NIST Standard Reference Database (SRD 130) because of its high visibility
- **I continue to update the website (via an HTML editor)…**

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Benefits of Website like STRBase

http://www.cstl.nist.gov/strbase

- Develops expertise when collecting information
- Requires NIST to stay up-to-date with field
- Provides transparency to our team's work
- Training tool and resource for the world
- Respected resource for >15 years
- ~10,000 pages of information available now
- >450,000 hits cumulative
- **Method for sharing information (PowerPoint files, population data, etc.)**

STRBase be a model for other forensic disciplines in sharing information with the forensic science community

Review of Some Recent STRBase Additions

Forensic STR Information

- STRs101: Brief Introduction to STRs
- *Core Loci*: FBI CODIS Core STR Loci and European Core Loci
- STR Fact Sheets (observed alleles and PCR product sizes)
- **Multiplex STR kits**
- Sequence Information (annotated)
- Variant Allele Reports
- Tri-Allelic Patterns
- Mutation Rates for Common Loci
- Published PCR primers
- Y-chromosome STRs
- Low-template DNA Information
- Mixture Interpretation
- Kinship Analysis
- miniSTRs (short amplicons)
- Null Alleles - discordance observed between STR kits
- STR Reference List - ***now 3687 references***

Information on Variant Alleles

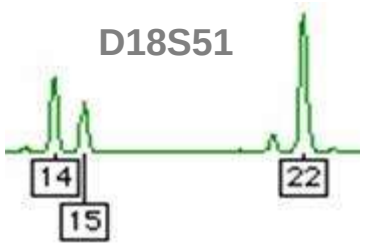
http://www.cstl.nist.gov/strbase/var_tab.htm

- We collect contributions from all over the world where unusual results have been observed with STR data
- Enables laboratories to check if others have seen a specific variant allele or tri-allelic pattern
- Currently (as of Oct 31, 2012 update)

  657 variants at 41 loci

  326 tri-allelic patterns at 33 loci

Type 1 tri-allelic pattern



From **D2S1338 Variants Table** (http://www.cstl.nist.gov/strbase/var_D2S1338.htm)

Allele Designation	Allele Size	Instrument	Amp Kit*	Contributor	Verification/Conformation Method(s)	Notes	Frequency
11	290.61	ABI 310	ID	Cintia alves, IPATIMUP, Porto, Portugal	Re-extracted and re-amplified	Portuguese Caucasian sample	1 in 780

Mixture Section of STRBase

http://www.cstl.nist.gov/strbase/mixture.htm

- **Training workshop slides** (thousands of slides of training materials available from 7 workshops)
- **SWGDAM Mixture Committee resource page** (contains worked mixture examples by Bruce Heidebrecht, Maryland State Police DNA Technical Leader)
- **Links to mixture interpretation software** (currently 12 links)
- **Literature references** (currently 144 articles)

Literature listing by topic for 144 articles

Topic category	# References
Mixture Principles & Recommendations	13
Setting Thresholds	11
Stutter Products & Peak Height Ratios	19
Stochastic Effects & Allele Dropout	18
Estimating the Number of Contributors	15
Mixture Ratios	9
Statistical Approaches	23
Low Template DNA Mixtures	8
Separating Cells to Avoid Mixtures	3
Software (plus 12 websites)	7
Probabilistic Genotyping Approach	11
General Information on Mixtures	7

NIST Applied Genetics

Outreach via Presentations

from the NIST Applied Genetics Group

- Present our research at **scientific conferences**
- **Conduct training workshops** at forensic labs
- **Visit universities** with forensic science programs
- **Teach via webinars** on specific topics
  - **NIST will host a mixture interpretation webinar on April 12, 2013** (goal is to reach DNA analysts world-wide)

In the past 2 years (Oct 2010-Nov 2012):

138 talks & posters

20 training workshops

Slide handouts and posters available at

http://www.cstl.nist.gov/strbase/NISTpub.htm

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Scientific Conferences (Past 2 Years)

Primary National Conferences

Feb 2011 Feb 2012	June 2011 June 2012	Sept 2011 Sept 2012	Oct 2011 Oct 2012	Nov 2011 Nov 2012

International Conferences

August 2011	July 2011

May 2012	May 2012	Aug 2012

Regional Forensic Meetings

May 2011 May 2012	Sept 2012	Oct 2011 Nov 2012	Sept 2012

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Crime Labs Visited (Past 2 Years)

Presentations were given in each lab reviewing NIST DNA research and providing requested training on forensic DNA topics

March 2011

March 2011

April 2011

Aug 2011

April 2011

April 2011

May 2011

June 2011

April 2012

May 2012

June 2012

Sept 2012

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Universities Visited (Past 2 Years)

THE GEORGE WASHINGTON UNIVERSITY
WASHINGTON DC

Nov 2010

GEORGE MASON UNIVERSITY

April 2011
Sept 2011
March 2012
May 2012*
***commencement address**

TOWSON UNIVERSITY

April 2011
May 2012

BOSTON UNIVERSITY

April 2011

PENNSTATE 1855

April 2011
Nov 2011

UNT HEALTH SCIENCE CENTER

April 2012

UNIVERSITY OF SOUTHERN INDIANA

March 2011

UTAH VALLEY UNIVERSITY

Nov 2011

BRIGHAM YOUNG UNIVERSITY FOUNDED BYU 1875 PROVO, UTAH

Nov 2011

LUND UNIVERSITY

Nov 2011

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Other Countries Visited (Past 2 Years)

Austria

Sept 2011

Innsbruck Medical University Institute of Legal Medicine

Belgium

Apr 2011

European DNA Profiling Group & European Network of Forensic Science Institutes

Canada

May 2012

Royal Canadian Mounted Police & Canadian Society of Forensic Science

Czech Republic

May 2012

Forensica conference

Denmark

June 2012

University of Copenhagen Institute of Forensic Medicine

Japan

Dec 2010

National Research Institute of Police Science

Korea

Nov 2012

Supreme Prosecutors' Office

Sweden

Nov 2011

National Laboratory of Forensic Science

Taiwan

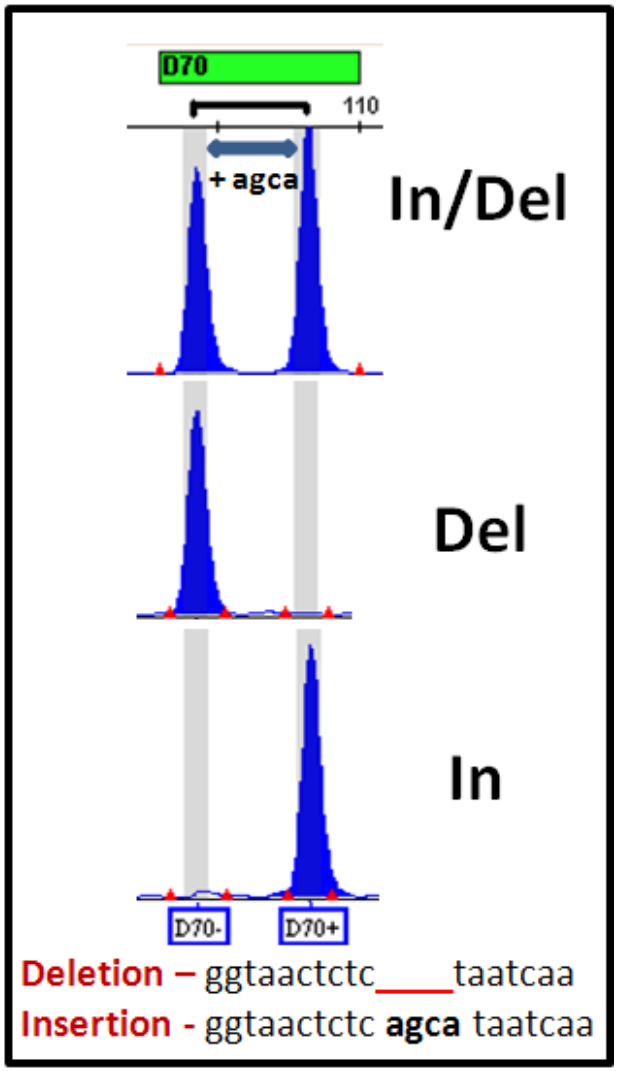
June 2012

Criminal Investigation Bureau Forensic Science Center

NIST Applied Genetics Group Hosted a **Spanish Guest Researcher** (Jan 2011 – July 2012)

Dr. Manuel Fondevila

Studied **commercial 30plex** (Qiagen DIPlex) and a **home-brew 38plex** in **U.S. population samples**



Int J Legal Med (2012) 126:725–737
DOI 10.1007/s00414-012-0721-7

Int. J. Legal Med. (2012) 126: 725-737

ORIGINAL ARTICLE

Forensic performance of two insertion–deletion marker assays

M. Fondevila · C. Phillips · C. Santos · R. Pereira · L. Gusmão · A. Carracedo · J. M. Butler · M. V. Lareu · P. M. Vallone

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Publications on Forensic DNA

from the NIST Applied Genetics Group

- **144 publications since 2002**
  - 40 in the past 2 years
  - Includes journal articles, book chapters, and textbooks
- References are all listed on STRBase
  - **http://www.cstl.nist.gov/strbase/NISTpub.htm**
  - Many are available directly from STRBase

Most of our articles are published in *Forensic Sci. Int. Genetics* – currently the highest impact journal in the field

136 page report written by Kevin Kiesler

NIST Report to the FBI:
Plex-ID Electrospray Time-of-Flight Mass Spectrometer for Mitochondrial DNA Base Composition Profiling

Experiments performed and report written by: Kevin Kiesler, M.S. (NIST)

Under the direction of: Dr. Peter Vallone (NIST)

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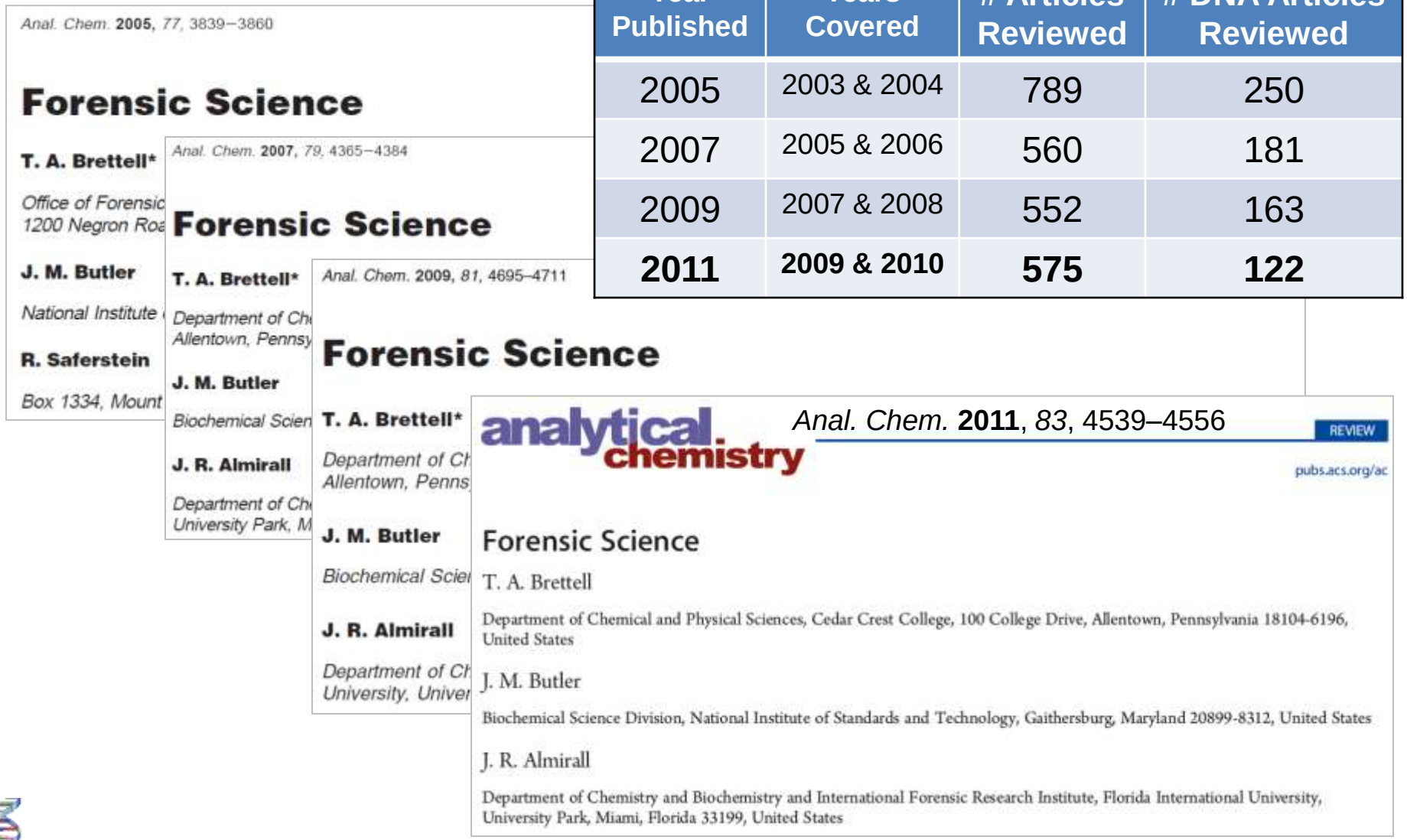
Application Review on Forensic Science

appears every other year in June 15 issue of *Analytical Chemistry*

Year Published	Years Covered	# Articles Reviewed	# DNA Articles Reviewed
2005	2003 & 2004	789	250
2007	2005 & 2006	560	181
2009	2007 & 2008	552	163
2011	**2009 & 2010**	**575**	**122**



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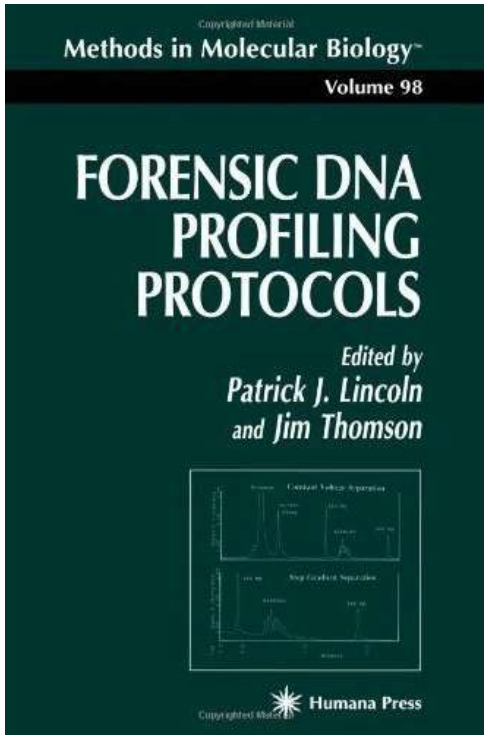
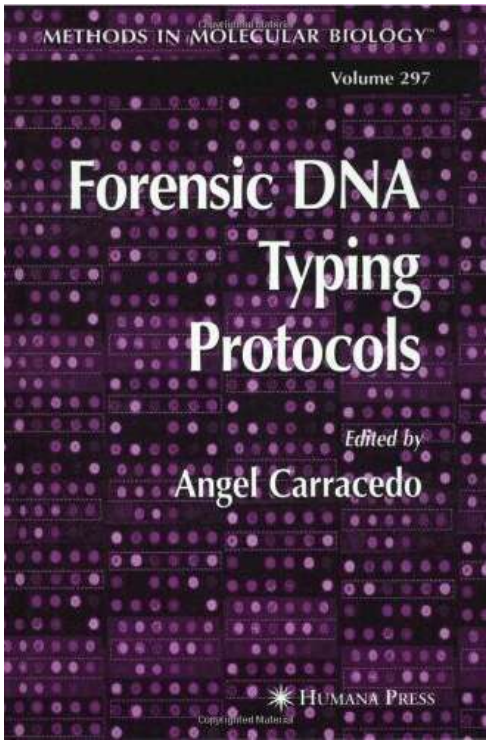
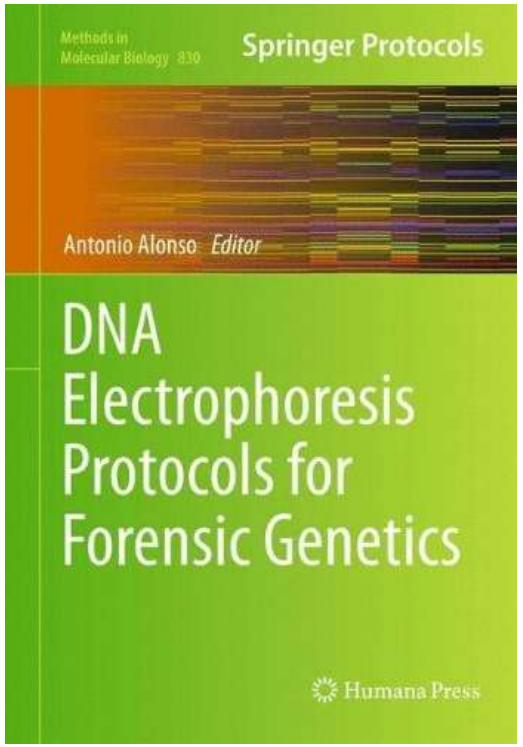
Contributing to Book Compilations



Humana Press
1998



Humana Press
2005



Humana Press
2012

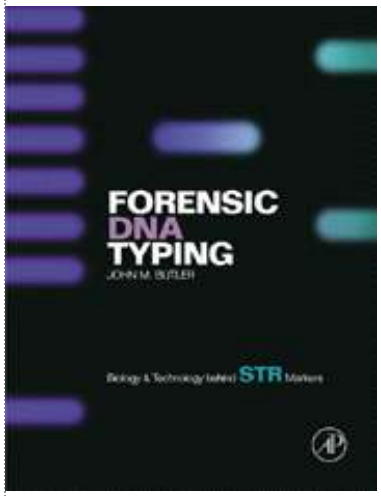
CRC Press
2013

The NIST Applied Genetics Group has contributed to every major book compilation regarding forensic DNA over the past 15 years

NIST Applied Genetics

Forensic DNA Typing Textbooks Have Set the Standard for the Field

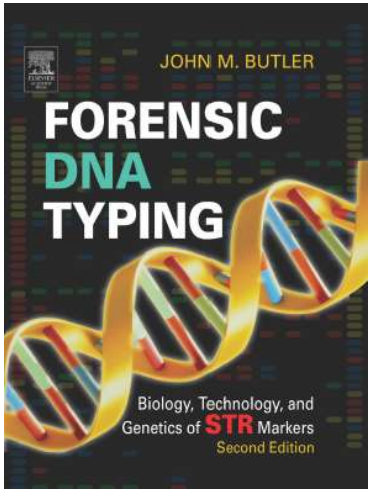
1st Edition



Jan 2001

335 pages

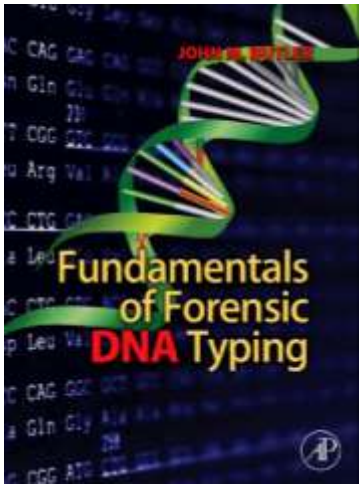
2nd Edition



Feb 2005

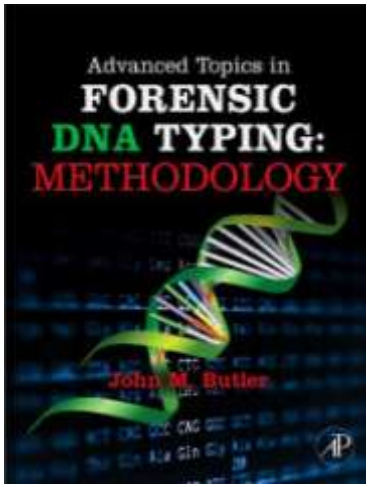
688 pages

3rd Edition (3 volumes)



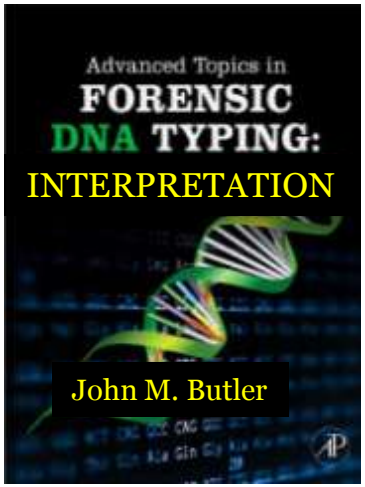
Sept 2009

520 pages



Aug 2011

704 pages



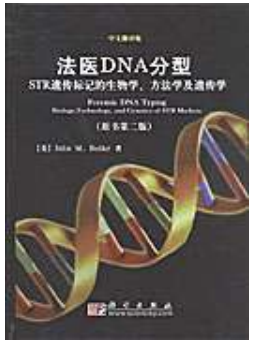
Fall 2013

(being written)

~500 pages

Language Editions

Chinese (2007)



Japanese (2009)

Writing these books is now part of my job here at NIST

(no royalties are received)

NIST Applied Genetics

Current Committee Contributions

SWGDAM (Scientific Working Group on DNA Analysis Methods)
http://www.swgdam.org

John Butler – Mixture Committee (chair)
Pete Vallone – Rapid DNA Committee (chair)
Mike Coble – Enhanced Detection Methods & Interpretation Committee

Held each Jan & July
(Fredericksburg, VA)

NIST/NIJ Technical Working Group on Biological Evidence Preservation

http://www.nist.gov/oles/forensics/crime_scene.cfm

Margaret Kline serves as a member

Virginia Department of Forensic Science – Scientific Advisory Committee

http://www.dfs.virginia.gov/about/saCommittee.cfm

John Butler serves as a member of the biology sub-committee

North Carolina State Bureau of Investigation Forensic Science Advisory Board

http://www.ncdoj.gov/About-DOJ/State-Bureau-of-Investigation/Crime-Lab/Forensic-Advisory-Board.aspx

Mike Coble serves as vice-chairman and member

Summary and Lessons Learned

- Need a good team to become the experts in the field – having the right people is crucial
- Comprehensively gather information, create standardized information formats that are useful, share what is learned through multiple avenues
- Be plugged into the community and willingly help meet their needs (visits to labs to conduct training workshops benefits labs and our understanding of their needs and challenges)

NIST Applied Genetics

Acknowledgments

Community feedback and contributors to the NIST STRBase website

Forensic DNA Team


John Butler


Mike Coble


Becky Hill


Margaret Kline


Dave Duewer

DNA Biometrics Team


Pete Vallone


Erica Butts


Kevin Kiesler

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

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301-975-4049

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Points of view are those of the presenters and do not necessarily represent the official position of the National Institute of Standards and Technology or the U.S. Department of Justice.