

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

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

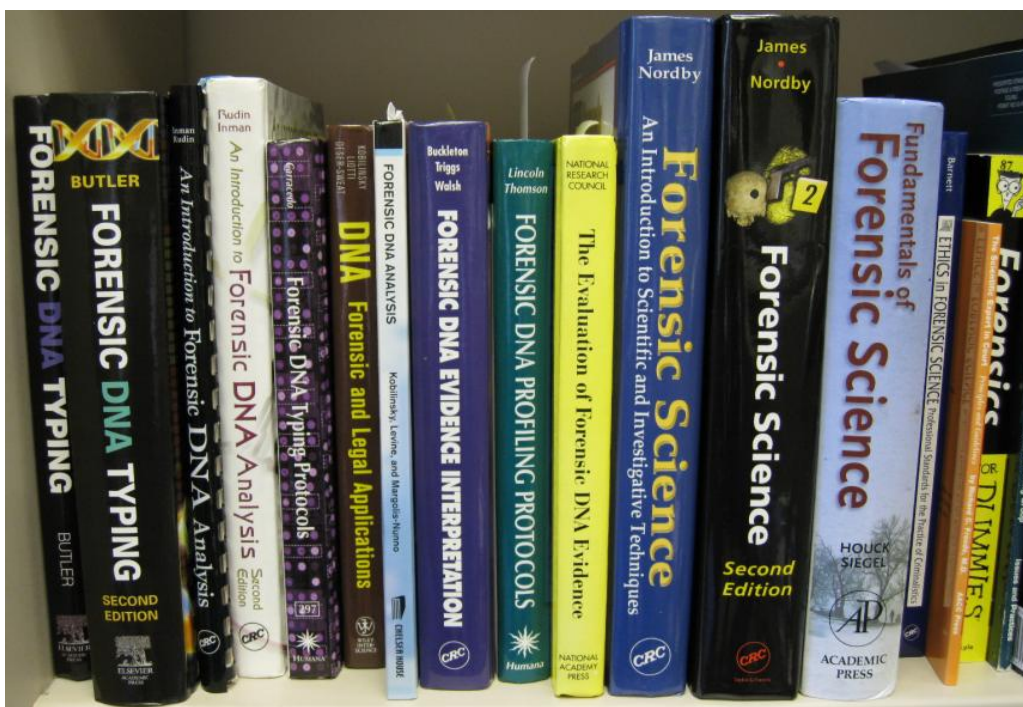
- STRBase website – its origin and content
- Training workshops
- *Forensic DNA Typing* textbooks

Committee contributions

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

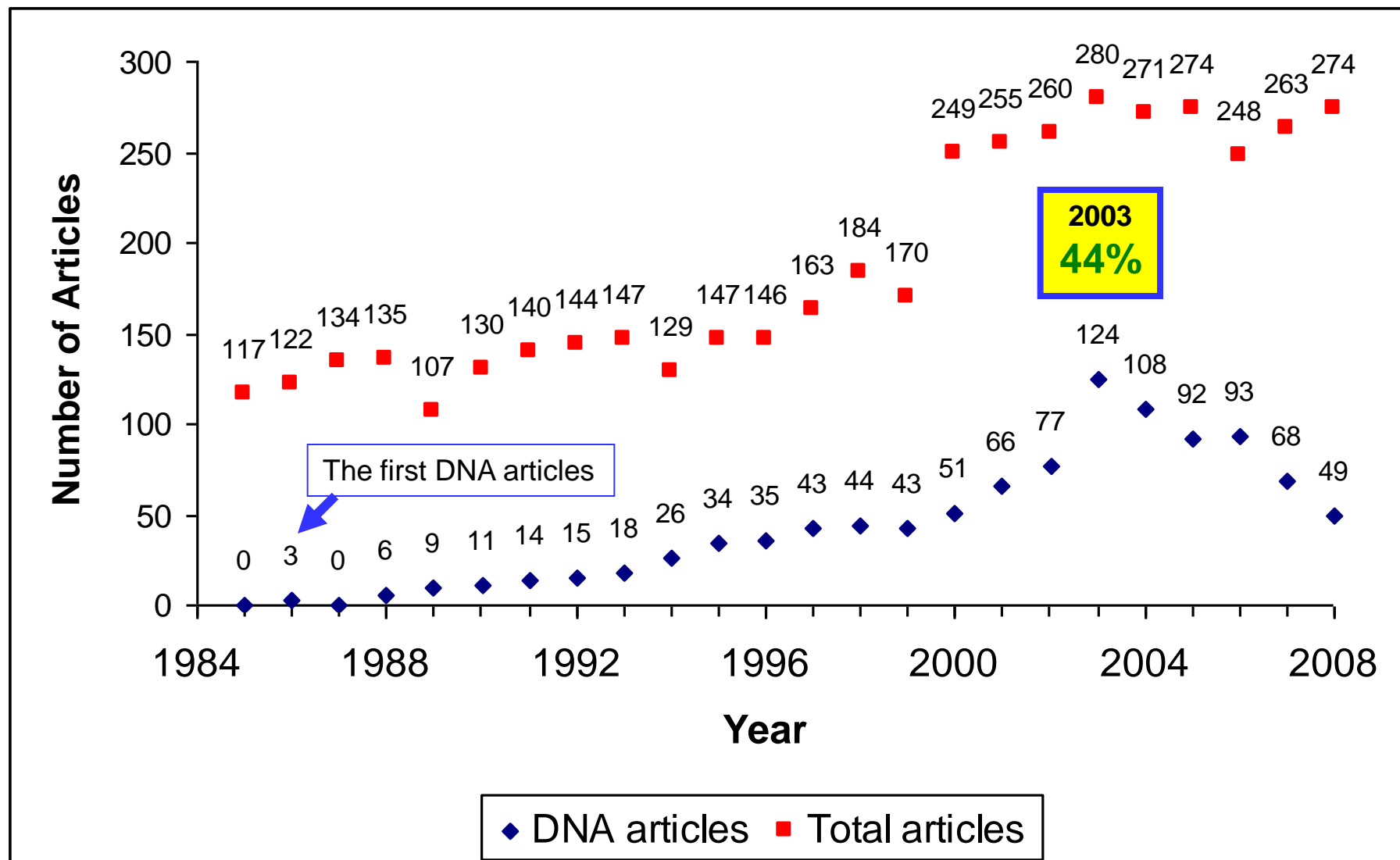
Collection of Journals in Our Group Library

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

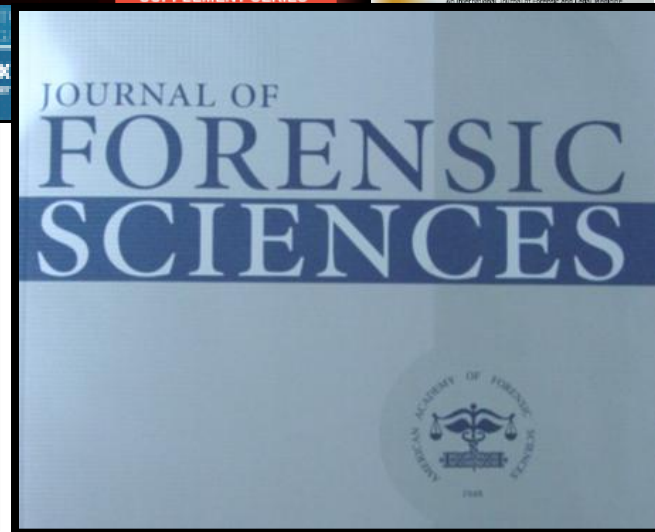
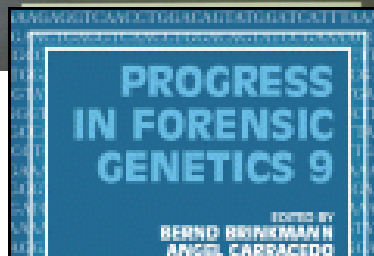


Journal of Forensic Sciences

DNA publications vs total articles



Forensic Science Publications



We Attend & Contribute Each Year to Numerous Scientific Meetings



AAFS



International Society
of Forensic Genetics



SWGAM



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**



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, 4385–4384

Analytical Chemistry (June 15, 2007 issue)

Forensic Science

T. A. Brettell*

Department of Chemical and Physical Sciences, Cedar Crest College, 100 College Drive, Allentown, Pennsylvania 18104-6196

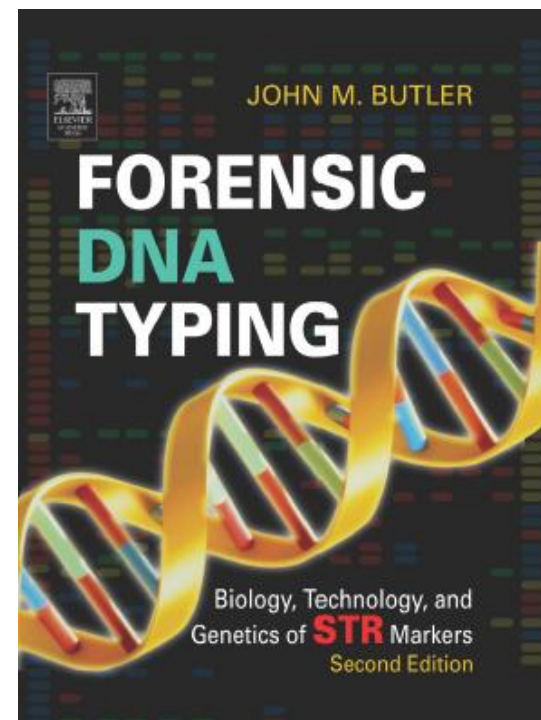
J. M. Butler

Biochemical Science Division, National Institute of Standards and Technology, Gaithersburg, Maryland 20899-8311

J. R. Almirall

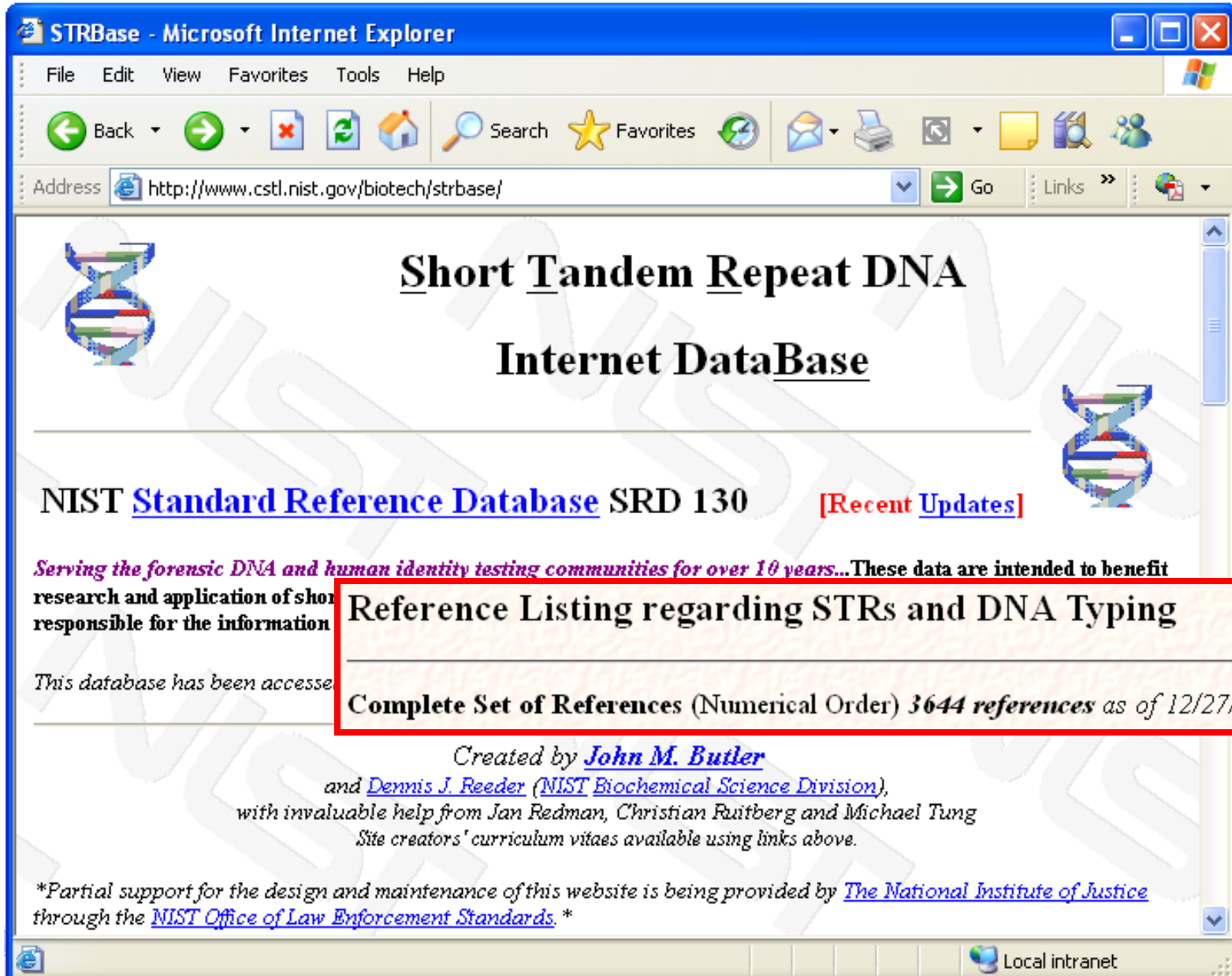
Department of Chemistry and Biochemistry and International Forensic Research Institute, Florida International University, University Park, Miami, Florida 33199

Textbooks



2nd Edition 688 pp.
Feb 2005

And a Useful Reference Website...



STRBase - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites Recycle Bin Mail Print Taskbar Links

Address <http://www.cstl.nist.gov/biotech/strbase/> Go Links

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 typing. The NIST Applied Genetics Laboratory is responsible for the information contained in this database.

This database has been accessed over 100,000 times since its inception.

Reference Listing regarding STRs and DNA Typing

Complete Set of References (Numerical Order) 3644 references as of 12/27/11

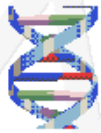
Created by [John M. Butler](#)
and [Dennis J. Reeder](#) ([NIST Biochemical Science Division](#)),
with invaluable help from Jan Redman, Christian Ruitberg and Michael Tung
Site creators' curriculum vitae available using links above.

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](#).

Local intranet

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
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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/>

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)...**

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

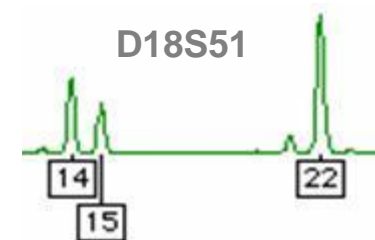
http://www.cstl.nist.gov/strbase/var_tab.htm

- 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)
- **SWGDM 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

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>

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 2011
May 2012



Sept 2012



Oct 2011
Nov 2012



May 2012



FORENSICA
2012

May 2012

Green Mountain
DNA Conference



Aug 2012



Sept 2012

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



**FBI
LABORATORY**

May 2012

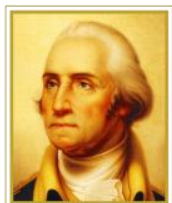


June 2012



Sept 2012

Universities Visited (Past 2 Years)



THE GEORGE
WASHINGTON
UNIVERSITY
WASHINGTON DC

Nov 2010



April 2011
Sept 2011
March 2012
May 2012*

*commencement address



April 2011
May 2012



April 2011



April 2011
Nov 2011



April 2012



March 2011



Nov 2011



Nov 2011



LUND
UNIVERSITY

Nov 2011

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

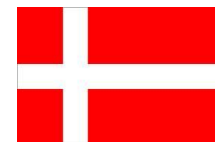
Czech Republic



May 2012

Forensica
conference

Denmark



June 2012

University of
Copenhagen
Institute of
Forensic
Medicine

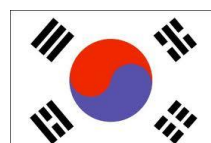
Japan



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

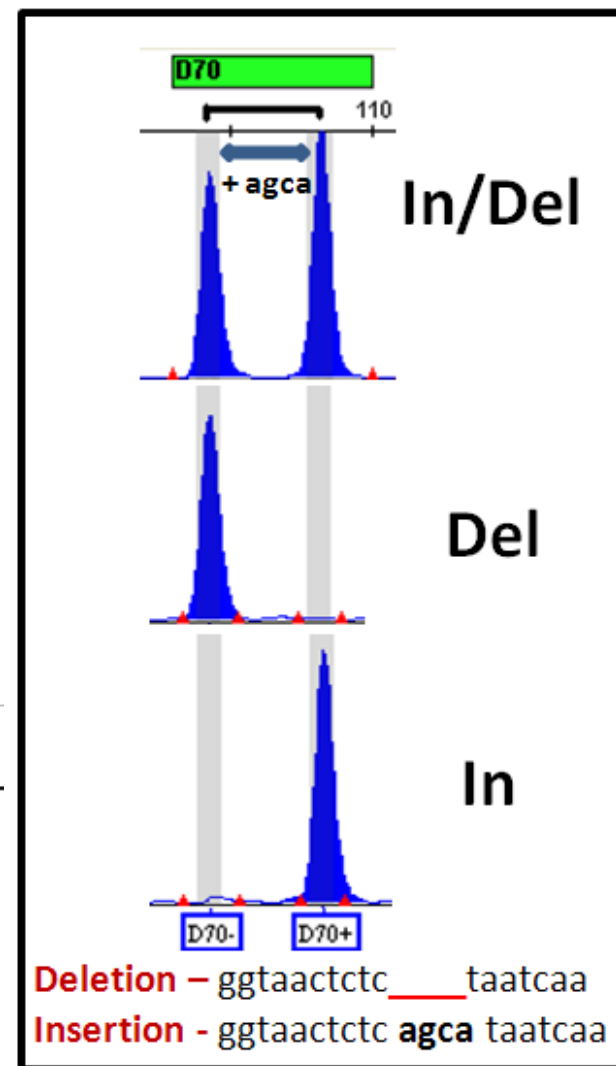
NIST Applied Genetics Group Hosted a **Spanish Guest Researcher** (Jan 2011 – July 2012)



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

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)

Application Review on Forensic Science

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

Anal. Chem. **2005**, *77*, 3839–3860

Forensic Science

T. A. Brettell*

Anal. Chem. **2007**, *79*, 4365–4384

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1200 Negron Road

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T. A. Brettell*

Anal. Chem. **2009**, *81*, 4695–4711

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Biochemical Science Division

T. A. Brettell*

**analytical
chemistry**

Anal. Chem. **2011**, *83*, 4539–4556

REVIEW

pubs.acs.org/ac

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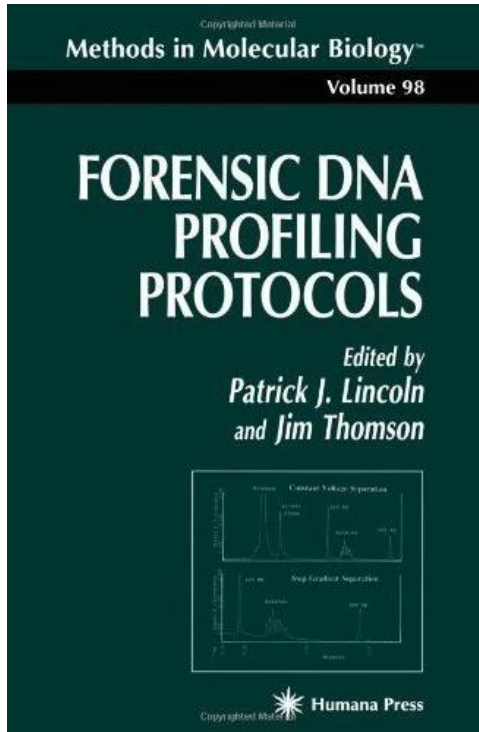
Biochemical Science Division, National Institute of Standards and Technology, Gaithersburg, Maryland 20899-8312, United States

J. R. Almirall

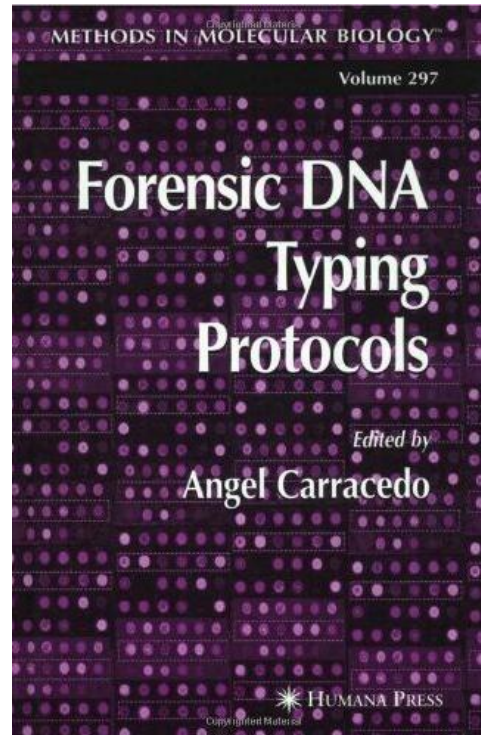
Department of Chemistry and Biochemistry and International Forensic Research Institute, Florida International University, University Park, Miami, Florida 33199, United States

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

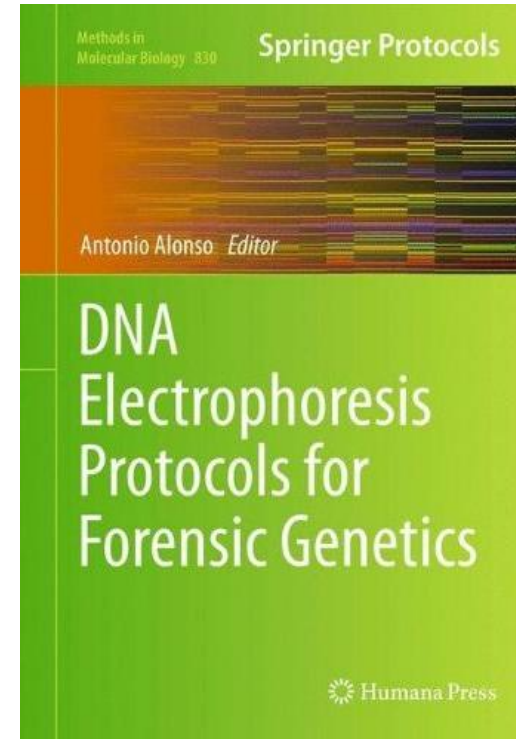
Contributing to Book Compilations



**Humana Press
1998**



**Humana Press
2005**



**Humana Press
2012**



**CRC Press
2013**

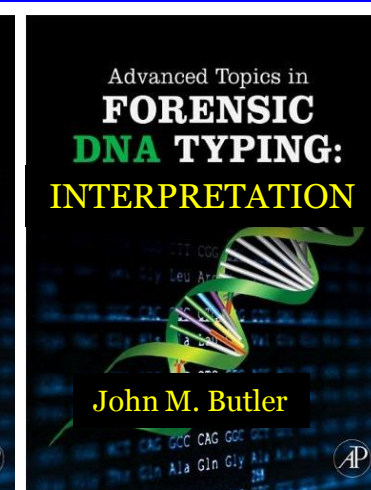
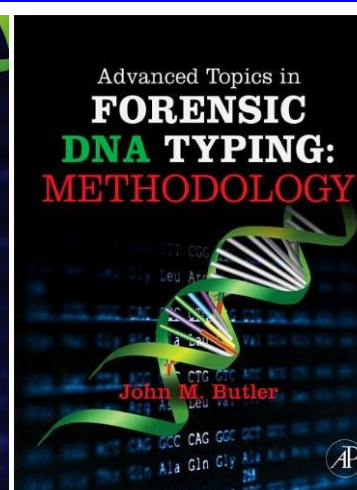
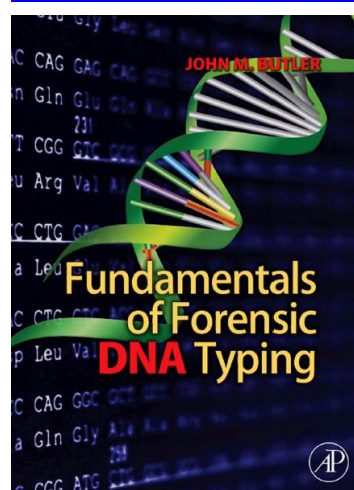
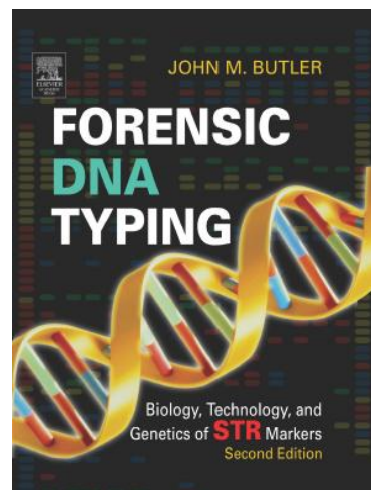
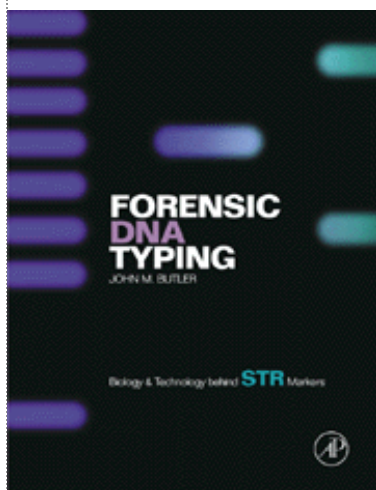
The NIST Applied Genetics Group has contributed to every major book compilation regarding forensic DNA over the past 15 years

Forensic DNA Typing Textbooks Have Set the Standard for the Field

1st Edition

2nd Edition

3rd Edition (3 volumes)



Jan 2001

Feb 2005

Sept 2009

Aug 2011

Fall 2013

335 pages

688 pages

520 pages

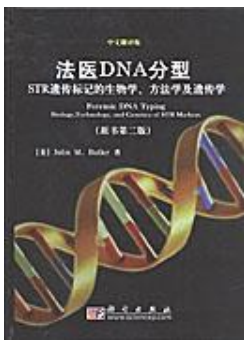
704 pages

(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)**

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)

Acknowledgments

Community feedback and contributors to the NIST STRBase website

Forensic DNA Team



John
Butler



Mike
Coble



Becky
Hill



Margaret
Kline



Dave
Duewer



Pete
Vallone



Erica
Butts



Kevin
Kiesler

DNA Biometrics Team

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

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



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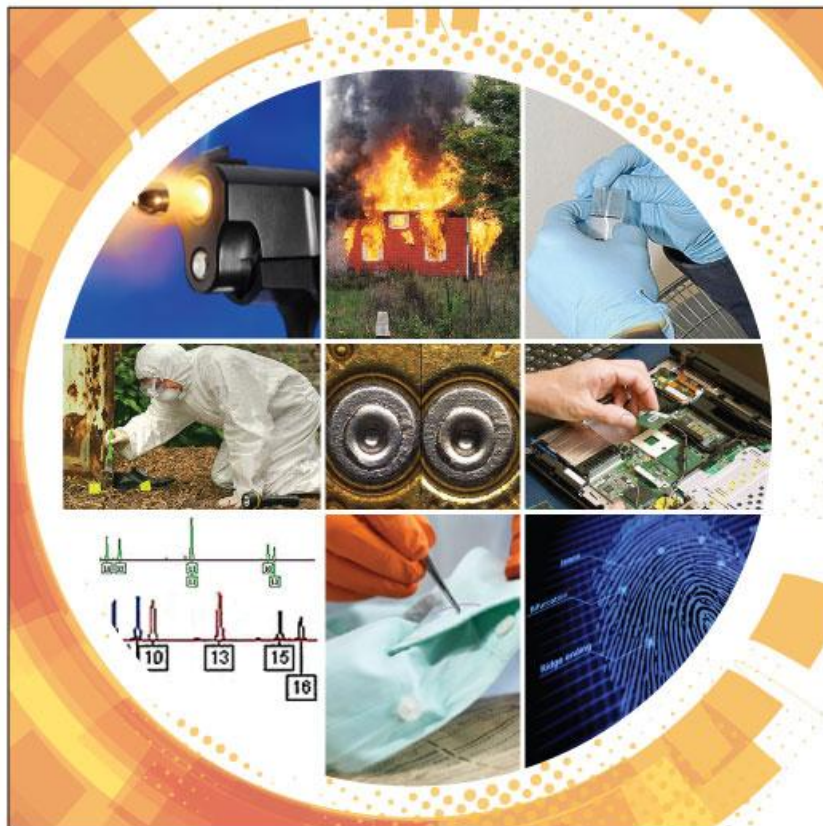


NIST Disclaimer: Certain commercial equipment, instruments and materials are identified in order to specify experimental procedures as completely as possible. In no case does such identification imply a recommendation or it imply that any of the materials, instruments or equipment identified are necessarily the best available for the purpose.



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.

Thank you for your attention!



FORENSICS @ NIST

November 28-30, 2012 • #NISTForensics

