Validating TrueAllele® interpretation of DNA mixtures containing up to ten unknown contributors

American Academy of Forensic Sciences
Criminalistics Section
February, 2018
Seattle, WA

Nasir Butt, PhD
Cuyahoga County Regional Forensic Science Laboratory
Cleveland, OH

David Bauer, PhD
Mark W Perlin, PhD, MD, PhD
Cybergenetics
Pittsburgh, PA

Cybergenetics

Cybergenetics © 2003-2018

Time to change

Failure is not an option

Success is just a click away

Forensic Science
- serves society
- empowers DNA
- uses computers
- unmixes mixtures
- promotes justice

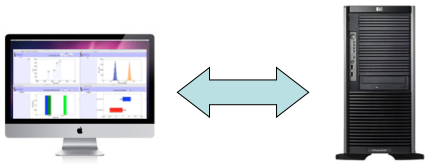
Fully Bayesian analysis

- **Input**: all mixture data
- Update all variables
- **Output**: separated genotypes
- Report likelihood ratio

Eliminate:
- Calibration bias
- "Picking & choosing" data
- Information loss
- "Inconclusive" results

All the genotypes, all the time

Ease of use



People see the pictures

Computers crunch the numbers

Easy to solve DNA problems, easy to testify about results

Validation study design

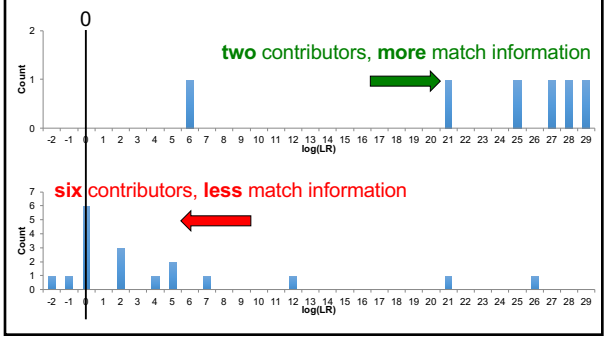
- 2 to 10 unknown contributors
  - demonstrate no limits
  - understand separation
- random mixtures
  - realistic composition
  - very low quantities
- independent analysis
  - results depend on system
  - not on lab or operator

Overall findings

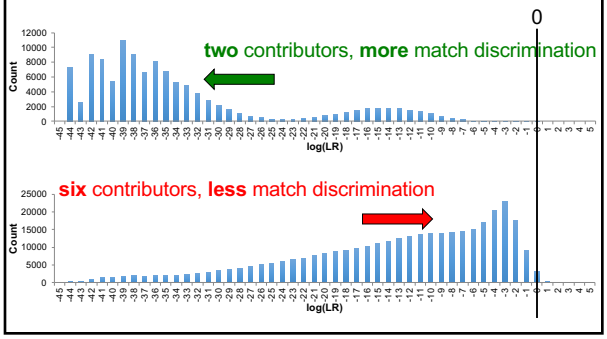
Sensitivity, specificity, reproducibility

- More DNA, better metrics
- More contributors, less DNA
- More sampling, better metrics
- Observed number of contributors
- Excess contributors, same results

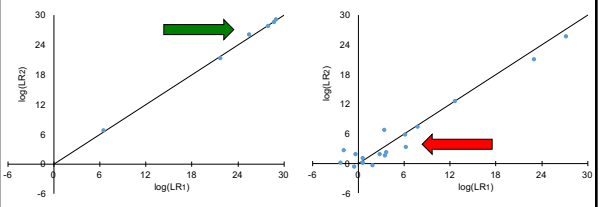
Sensitivity



Specificity



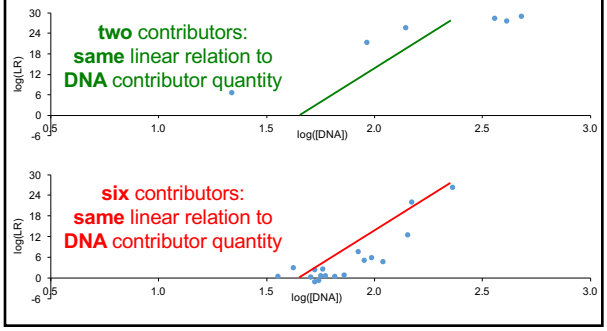
Reproducibility



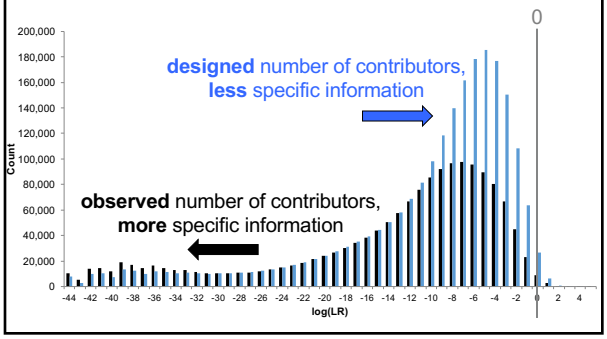
two contributors
more DNA
less match variation

six contributors
less DNA
more match variation

DNA amount



Contributor number



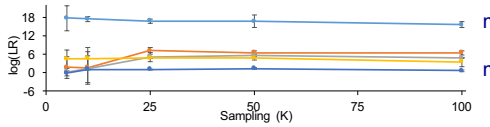
Peeling genotypes

	Peeling Round						
	0	1	2	3	4	5	6
% DNA	log(LR)						
13	7.1	K	K	K	K	K	K
22	5.7	7.4	K	K	K	K	K
12	5.1	4.3	5.5	K	K	K	K
16	3.9	3.8	5.2	6.3	K	K	K
13	3.5	2.8	2.5	1.3	6.1	K	K
15	3.2	3.2	4.0	1.1	5.6	8.4	K
2	1.4	0.9	1.3	1.1	2.8	2.9	4.1
2	0.2	2.3	1.8	2.7	2.3	2.5	3.6
4	0.1	1.0	0.6	1.3	2.5	0.4	1.8
1	-0.2	0.1	0.1	-0.3	-1.0	-0.7	-0.1

MCMC sampling

Five contributors (observed in the EPG data)

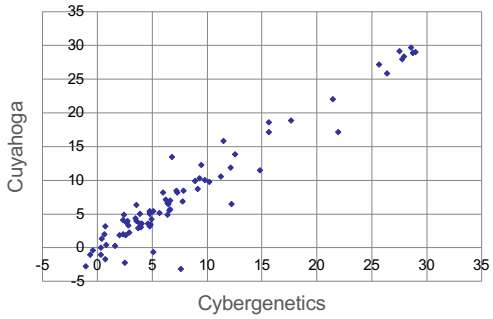
Longer sampling, better metrics



major to minor

25,000 cycles sufficient

Independent testing



Now is the time to change

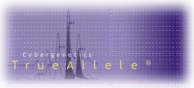
Failure is unnecessary

Success in validated science

Forensic Science
- serves society
- empowers DNA
- uses computers
- unmixes mixtures
- promotes justice

More information

http://www.cybgen.com/information



- Courses
- Newsletters
- Newsroom
- Presentations
- Publications
- Webinars

http://www.youtube.com/user/TrueAllele
TrueAllele YouTube channel

Cybergenetics

perlin@cybgen.com