1

TrueAllele® Casework takes NGS from the laboratory into the courtroom

Mid-Atlantic Association of Forensic Scientists

Richmond, Virginia
May, 2025

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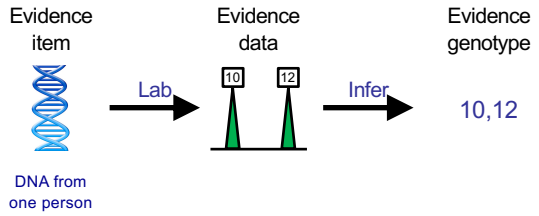
Mark W Perlin, PhD, MD, PhD

Cybergenetics

2

DNA evidence interpretation



3

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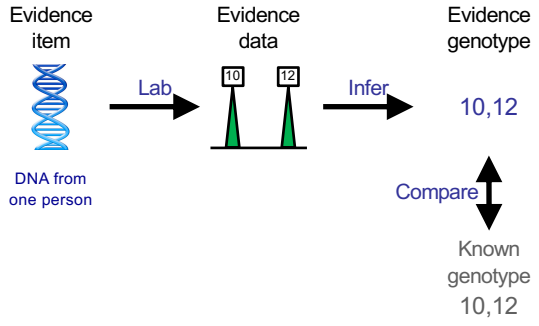
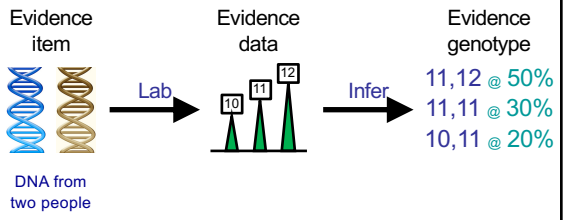


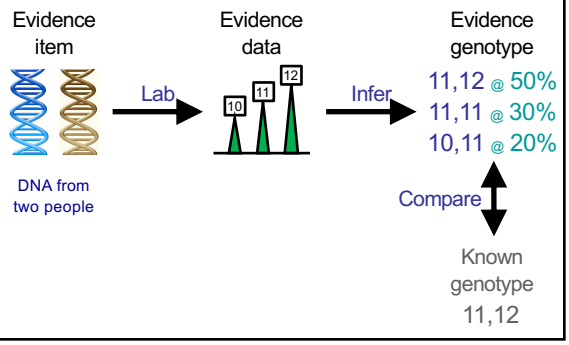
4

DNA mixture interpretation



5

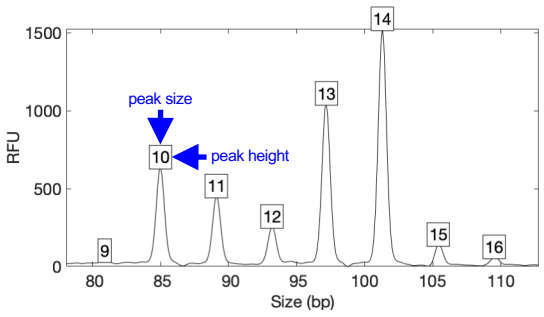
DNA mixture interpretation



6

Computers can use all the data

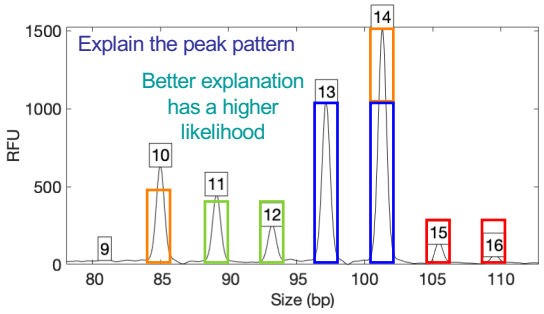
Quantitative peak heights at locus D2S441



7

How the computer thinks

Consider every possible genotype solution

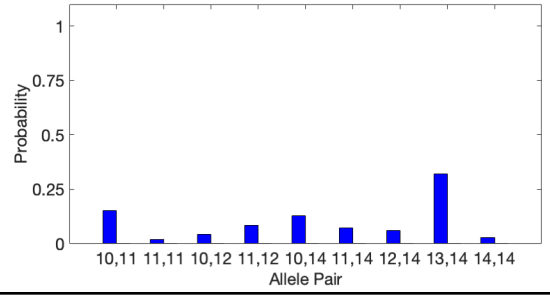


8

Evidence genotype

Objective genotype determined solely from the DNA data.

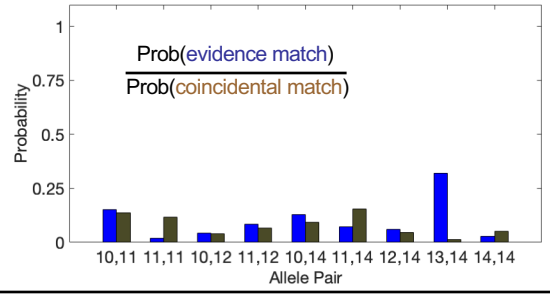
Never sees a comparison reference.



9

Identification information

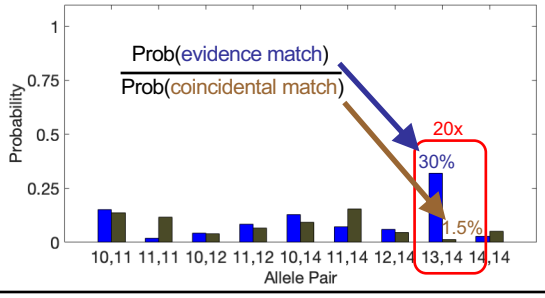
How much more does someone match the evidence than a random person?



10

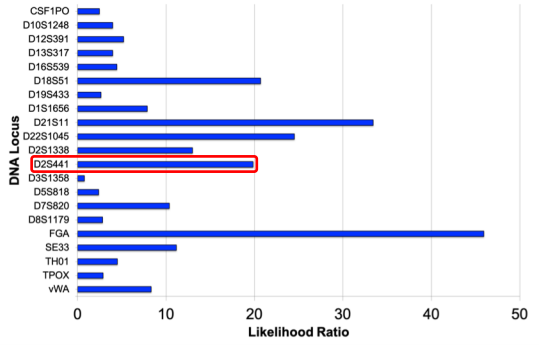
DNA match information

How much more does the suspect match the evidence than a random person?



11

LR information at 21 loci



12

Report results

A match between the handgun trigger and John Doe is:

246 quadrillion times more probable than a coincidental match.

13

Error rate

For a match strength of 246 quadrillion,
on this evidence genotype,
only 1 in 2.34 septillion people would match as strongly.

14

Court Testimony

Q. What is the final match statistic between the handgun trigger and Mr. Doe?

A. So I will read this directly from my report. A match between the handgun trigger … item 11A … and Mr. John Doe … item 4A is **two hundred and forty-six quadrillion times more probable** than a coincidental match to an unrelated person. The **error rate** for this match statistic is **one in two septillion** people.

TrueAllele validations

15

Perlin MW, Sinelnikov A. An information gap in DNA evidence interpretation. *PLoS ONE*. 2009;4(12):e8327.

Ballantyne J, Hanson EK, Perlin MW. DNA mixture genotyping by probabilistic computer interpretation of binomially-sampled laser captured cell populations: Combining quantitative data for greater identification information. *Science & Justice*. 2013;53(2):103-114.

Perlin MW, Hornyak J, Sugimoto G, Miller K. TrueAllele® genotype identification on DNA mixtures containing up to five unknown contributors. *Journal of Forensic Sciences*. 2015;60(4):857-868.

Greenspoon SA, Schiermeier-Wood L, Jenkins BC. Establishing the limits of TrueAllele® Casework: a validation study. *Journal of Forensic Sciences*. 2015;60(5):1263-1276.

Bauer DW, Butt N, Hornyak JM, Perlin MW. Validating TrueAllele® interpretation of DNA mixtures containing up to ten unknown contributors. *Journal of Forensic Sciences*. 2020; 65(2):380-398.

Perlin MW, Legler MM, Spencer CE, Smith JL, Allan WP, Belrose JL, Duceman BW. Validating TrueAllele® DNA mixture interpretation. *Journal of Forensic Sciences*. 2011;56(6):1430-1447.

Perlin MW, Belrose JL, Duceman BW. New York State TrueAllele® Casework validation study. *Journal of Forensic Sciences*. 2013;58(6):1458-1466.

Perlin MW, Dormer K, Hornyak J, Schiermeier-Wood L, Greenspoon S. TrueAllele® Casework on Virginia DNA mixture evidence: computer and manual interpretation in 72 reported criminal cases. *PLOS ONE*. 2014;(9):e92837.

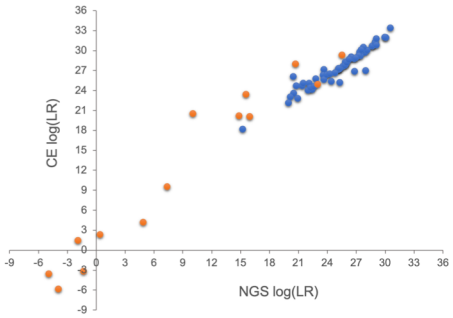
16

TrueAllele NGS validation

- Kern Regional Crime Laboratory (Bakersfield, CA)
- MiSeq FGx Sequencing System
- Verogen ForenSeq DNA Signature Prep Kit Primer Mix B
- Single source sensitivity samples
- Mock case samples
  - Up to 5 contributors
- Concordance samples (CE and NGS)

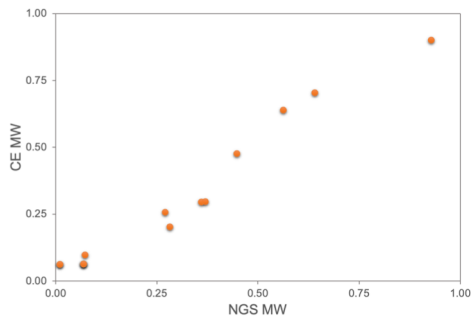
17

TrueAllele NGS validation



18

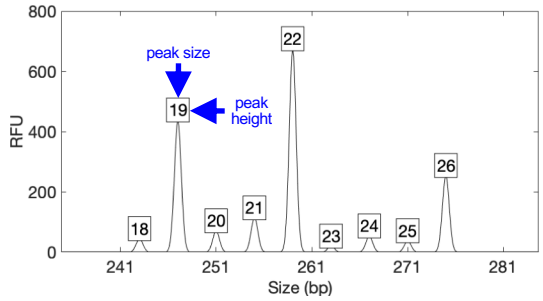
TrueAllele NGS validation



19

Computers can use all the data

Quantitative peak heights at locus FGA



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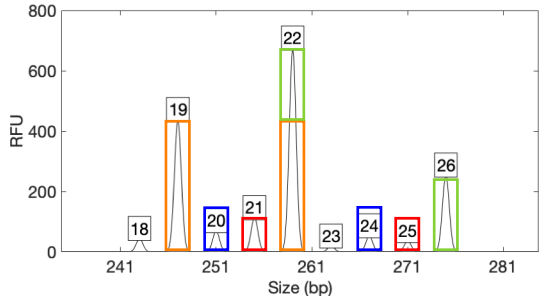

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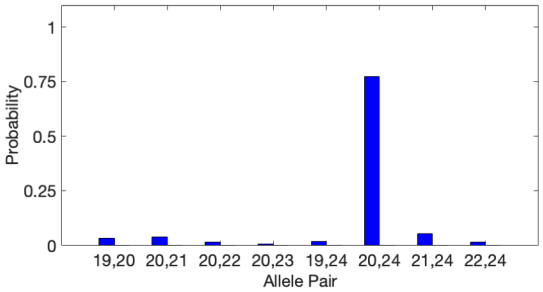

22

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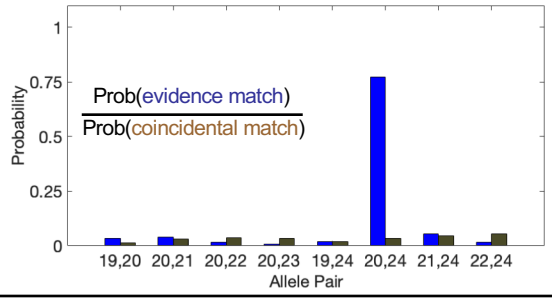
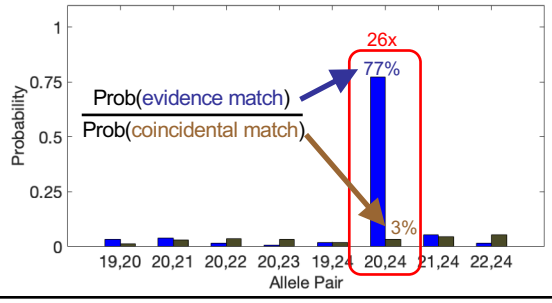


23

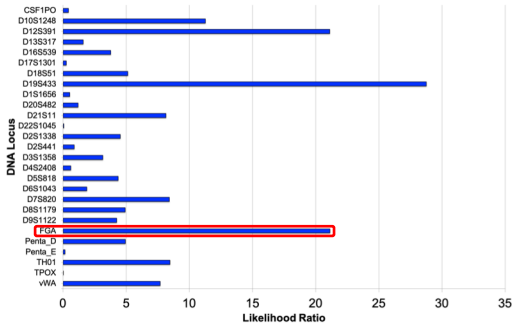
DNA match information

How much more does the suspect match the evidence than a random person?



24

LR information at 27 loci



25

Report results

A match between the handgun trigger
and John Doe is:

2.69 billion times more probable than a coincidental match.

26

Error rate

For a match strength of 2.69 billion,
on this evidence genotype,
only 1 in 99.2 billion people would match as strongly.

27

Court Testimony

Q. What is the final match statistic between the handgun trigger and Mr. Doe?

A. So I will read this directly from my report. A match between the handgun trigger … item 11A … and Mr. John Doe … item 4A is **two billion times more probable** than a coincidental match to an unrelated person. The **error rate** for this match statistic is **one in ninety-nine billion** people.

28

Conclusion

In Chemistry

PV = nRT

In Physics

F = ma

In TrueAllele

NGS = CE

Cybergenetics

made in USA