New York State Police Validation of TrueAllele: a Statistical Tool for Genotype Inference and Match that Solves Casework Mixtures Problems

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Why?

- Increased Automation

- Increased Sample Processing

- Bottleneck at Data Interpretation & Peer Review

- Despite sample automation – limited increase in throughput.

Outline of Validation

- 41-Adjudicated cases

- A variety of case types

- Varying degrees of complexity

- Original raw data files

Range of Evidence Items

- 368 total evidence items (Epi & Spm = 2 items)
  - 97 Reference Samples
  - 25 Vaginal, Anal, or Penile Swabs
  - 39 Semen Stains
  - 13 Clothing or Bedding
  - 11 Weapons
  - 69 Bloodstains
  - 9 Fingernail Scrapings
  - 8 Dried Secretions
  - 32 Misc (cigarette, condom, hair, bite marks, etc.)

Single-source Profiles

- 202 Single-Source Profiles in study
  - 4958 concordant allele calls
  - All profiles were concordant

- NYSP has had TrueAllele online in their Databank section since 2007.
  - To date, processed more than one hundred thousand sample successfully.

Case Classifications

- Cases assigned a degree of difficulty

  - Simple: 2-person mixtures with known victim

  - Moderate: 2-unknown mixture samples

  - Complex: partial profiles, 3 or more unknown contributors to mixtures

Simple

Victim – orange
Suspect - blue

Descrip	Single source NYSP Vic Ref	Single source TA Vic Ref	Single source NYSP Sus Ref	Single source TA Sus Ref	Unique separation NYSP Vag swab - SF	Unique separation TA 1 unk w/ vic ref	Unique separation TA 1 unk w/ vic ref	Single source NYSP Vag swab - NSF	Single source TA Vag swab - NSF
D3S1358	14,16	14,16	15,16	15,16	14,15,16*	14,16	15,16	14,16	14,16
vWA	18,19	18,19	13,18	13,18	13,18,19*	18,19	13,18	18,19	18,19
FGA	19,21	19,21	24,26	24,26	19,21,24,26*	19,21	24,26	19,21	19,21
D8S1179	10	10	13,15	13,15	10,13,15*	10	13,15	10	10
D21S11	28,29	28,29	31	31	28,29,31*	28,29	31	28,29	28,29
D18S51	13,15	13,15	15,16	15,16	13,15,16*	13,15	15,16	13,15	13,15
D5S818	11,12	11,12	8,13	8,13	8,11,12,13*	11,12	8,13	11,12	11,12
D13S317	8,12	8,12	11,12	11,12	8,11,12*	8,12	11,12	8,12	8,12
D7S820	9,11	9,11	10,13	10,13	9,10,11,13*	9,11	10,13	9,11	9,11
D16S539	12,14	12,14	11,13	11,13	11,12,13,14*	12,14	11,13	12,14	12,14
TH01	6	6	7,8	7,8	6,7,8*	6	7,8	6	6
TPOX	8,11	8,11	10	10	8,10,11*	8,11	10	8,11	8,11
CSF1PO	11	11	11,12	11,12	11,12	11	11,12	11	11
AMEL	X	X	X,Y	X,Y	X,Y	X	X,Y	X	X
Stats					TA MLR 18.3 / Loci match 13/13 / Mix Calc 36%	19.4 / 13/13 / 64%		TA MLR 18.3 / Loci match 13/13 / Mix Calc NA	

Moderate

Victim – orange
Suspect - blue

Descrip	Possible mixture NYSP Fngrnl scrpg-R & L hands	Possible mixture TA 1 unk	Single-source NYSP Anal swabs - SF	Single-source TA 1 unk	Unique separation NYSP Anal swabs - NSF	Unique separation TA 1 unk w/ vic ref	Unique separation TA 1 unk w/ vic ref	Unique separation NYSP Vag swab - SF	Unique separation TA 1 unk w/ vic ref	Unique separation TA 1 unk w/ vic ref
D3S1358	16,18,19*	16,19	18	18	16,18,19*	16,19	18	16,18,19*	16,19	18
vWA	17	17	14,17	14,17	14,17	17	14,17	14,17	17	14,17
FGA	21,22	21,22	22,26	22,26	21,22,25,26*	21,22	22,26	21,22,26*	21,22	22,26
D8S1179	12,15	12,15	13,15	13,15	12,13,15*	12,15	13,15	12,13,15*	12,15	13,15
D21S11	30,31.2	30,31.2	(30,32.2)	30,32.2	30,31.2,32.2*	30,31.2	30,32.2	30,31.2,32.2*	30,31.2	30,32.2
D18S51	14,17	14,17	16,18	16,18	14,16,17,18*	14,17	16,18	14,16,17,18*	14,17	16,18
D5S818	11,12	11,12	12	12	11,12	11,12	12	12	11,12	12
D13S317	8,11	8,11	10,13	10,13	8,10,11,13*	8,11	10,13	8,10,11,12,13*	8,11	10,13
D7S820	7,13	7,13	10,12	10,12	7,10,12,13*	7,13	10,12	7,10,12,13*	7,13	10,12
D16S539	11	11	10,12	10,12	10,11,12*	11	10,12	10,11,12*	11	10,12
TH01	7	7	8,9	8,9	7,8,9*	7	8,9	7,8,9*	7	8,9
TPOX	8,9	8,9	8	8	8,9	8,9	8	8,9	8,9	8
CSF1PO	11,12	11,12	9,14	9,14	9,11,12,14*	11,12	9,14	9,11,12,14*	11,12	9,14
AMEL	X	X	X,Y	X,Y	X,Y	X	X,Y	X,Y	X	X,Y
Stats	TA MLR 18.1 / Locl Match 13/13 / Mix Calc NA		TA MLR 19.6 / Locl Match 13/13 / Mix Calc NA		TA MLR 18.1 / Locl Match 13/13 / Mix Calc 14%	19.6 / 13/13 / 86%		TA MLR 18.1 / Locl Match 13/13 / Mix Calc 12%	19.6 / 13/13 / 88%	

Complex

Victim – orange
Suspect – blue
Suspect - green

Descrip	3-person mixture NYSP	TA 2 unk w/ vic ref Swab of latex		
D3S1358	13,14,15,17,19*	15,19	13,17	14,15
vWA	15,16,17*	15	16,17	16,17
FGA	22,23,24,25,27*	23,25	21,22,27	22,24
D8S1179	12,14,15,16*	12,16	14,15,16	14,15
D21S11	29,30,31,32.2*	29,31	29,30,31,32.2	30,31
D18S51	12,17,18*	12	12,17,18	17,18
D5S818	12,13	12,13	11,12	12
D13S317	10,12,13,14*	10,13	10,13,14	10,12
D7S820	9,10,12,13*	12,13	9,10,13	9,10,13
D16S539	9,10,12,13*	12,13	10,12	9,10
TH01	7,9,9.3*	9,9.3	8,9,9.3	7,9.3
TPOX	8,9,11*	8	9,11	11
CSF1PO	7,9,10,11*	11	7,9,10,11	7,9,10
AMEL	X,Y	X,Y	X,Y	X
Stats	TA MLR 20.07 / LOCI Match 13/13 / Mix Calc 58%	6.11 / 12/13 / 13%	12.55 / 12/13 / 29%	

Mixing Weight

- There were 88 mixture samples in the study.

- The mixing weight is modeled for mixture samples, with an associated probability distribution.

- As the uncertainty of the data increases, the probability distribution increases.

Statistical Strength

- As the data interpretation difficulty increases, the statistical strength decreases – for both human and computer-based methods.

- However, the computer-based method is still able to preserve more identification information with every sample.

Conclusions

TrueAllele is capable of:
- Unattended quality checks and data review

- Standardization of mixture interpretation

- Unbiased approach to data interpretation

- Increased sample processing capabilities

NYSP Looks to Achieve

- Analyst assistance with difficult mixtures

- Reduced peer review case file bottleneck

- And thus, increased throughput

Aknowledgements

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Questions?

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