

**Compute first, ask questions later:  
an efficient TrueAllele® workflow**

Midwestern Association  
of Forensic Scientists  
October, 2014  
St. Paul, MN

Martin Bowkley, MS & Mark W Perlin, PhD, MD, PhD  
Cybergenetics, Pittsburgh, PA



Cybergenetics

Cybergenetics © 2003-2014

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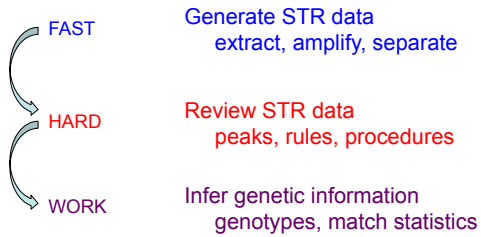
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**Data review bottleneck**



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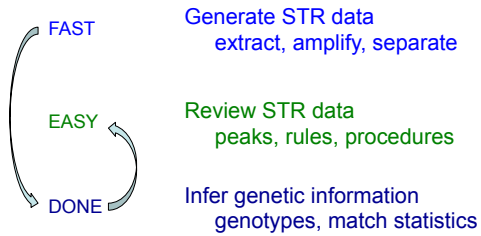
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**Pre-analyze by computer**



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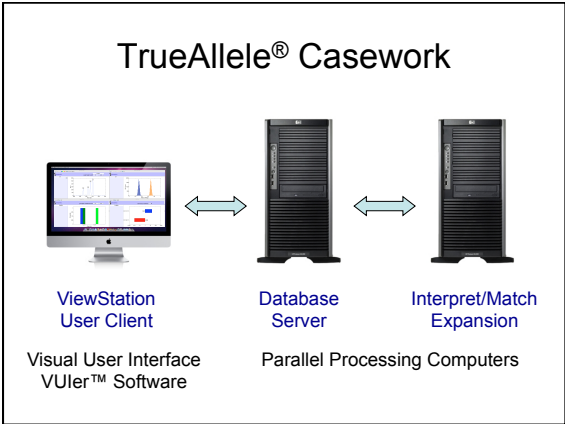
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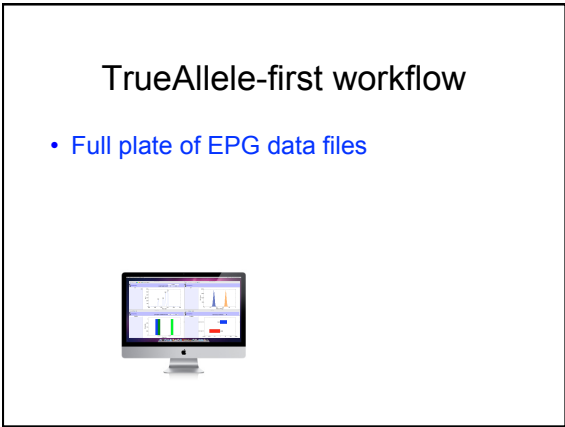
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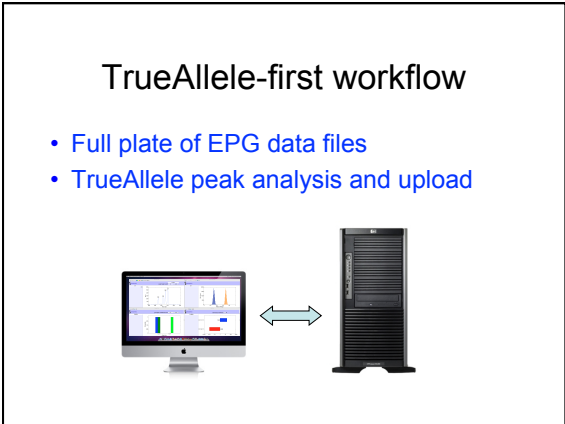
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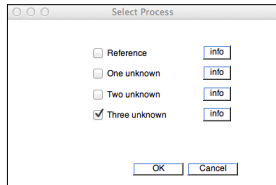
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## TrueAllele-first workflow

- Full plate of EPG data files
- TrueAllele peak analysis and upload
- Analyst asks computer all questions



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## TrueAllele-first workflow

- Full plate of EPG data files
- TrueAllele peak analysis and upload
- Analyst asks computer all questions
- Computer solves, provides answers

Separated genotypes  
Mixture weights  
Likelihood ratios

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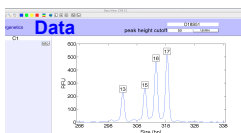
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## Visual user interfaces



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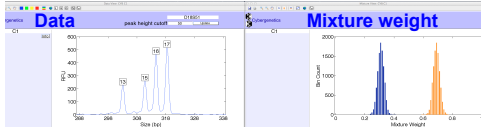
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## Visual user interfaces



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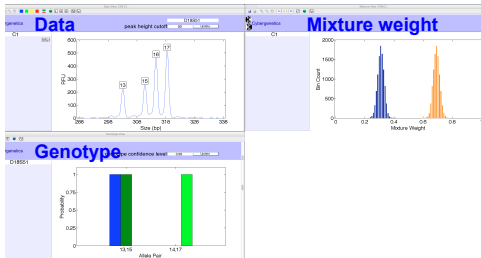
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## Visual user interfaces



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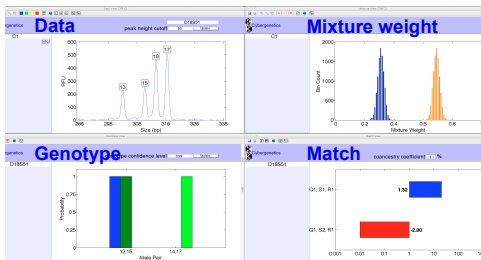
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## Visual user interfaces



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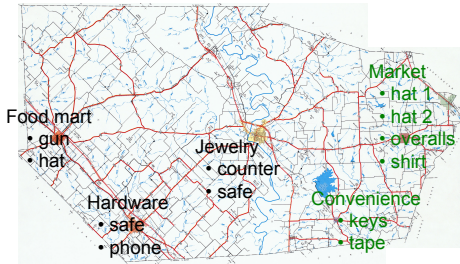
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## Evidence from multiple scenes




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## Laboratory DNA processing

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|-------------------|--------------------|
| 12 evidence items | 10 reference items |
| <b>Scene 1</b>    | • gun              |
|                   | • hat              |
| <b>Scene 2</b>    | • safe             |
|                   | • phone            |
| <b>Scene 3</b>    | • counter          |
|                   | • safe             |
| <b>Scene 4</b>    | • keys             |
|                   | • tape             |
| <b>Scene 5</b>    | • hat 1            |
|                   | • hat 2            |
|                   | • overalls         |
|                   | • shirt            |
|                   | 5 victims          |
|                   | • V1               |
|                   | • V2               |
|                   | • V3               |
|                   | • V4               |
|                   | • V5               |
|                   | 5 suspects         |
|                   | • S1               |
|                   | • S2               |
|                   | • S3               |
|                   | • S4               |
|                   | • S5               |

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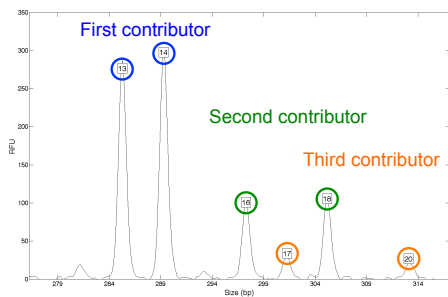
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## Lab develops STR data




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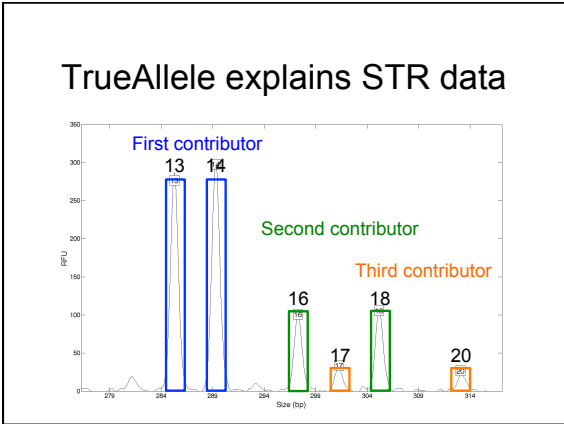
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### TrueAllele computes genotypes

For each contributor, at every locus

Allele pair	Probability
16, 18	65%
14, 18	12%
13, 18	10%
18, 20	8%
17, 18	4%

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### TrueAllele match results

log(LR)	Suspect 1	Suspect 2	Suspect 3	Suspect 4	Suspect 5
1. Gun					4
1. Hat	3				4
2. Safe					
2. Phone					
3. Counter		6			
3. Safe					
4. Keys					
4. Tape					
5. Hat 1					6
5. Hat 2					
5. Overalls					11
5. Shirt					3

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## Review data, prepare report



A **match** between the **evidence** and the **suspect** is **553 million times more probable** than a **coincidental match** to an unrelated **Black** person

M. W. Perlin, "Easy reporting of hard DNA: computer comfort in the courtroom," *Forensic Magazine*, vol. 9, pp. 32-37, 2012.

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## Validated genotyping method

Perlin MW, Sineitnikov 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):103-14.

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;in press.

Greenspoon SA, Schiermeier-Wood L, Jenkins BC. Establishing the limits of TrueAllele® Casework: a validation study. *Journal of Forensic Sciences*. 2015;in press.

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):1430-47.

Perlin MW, Belrose JL, Duceman BW. New York State TrueAllele® Casework validation study. *Journal of Forensic Sciences*. 2013;58(6):1458-66.

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)3:e92837.

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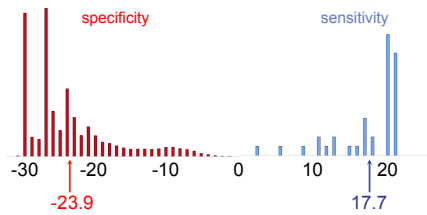
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M. W. Perlin, "Investigative DNA databases that preserve identification information," *American Academy of Forensic Sciences 64th Annual Meeting*, Atlanta, GA, 2012.

## TrueAllele genotype database

Highly specific, avoids false database hits



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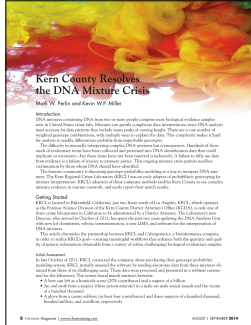
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# Kern County workflow



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# Harvest database matches

Within case

Select	Case 1	Item 1	Case 2	Item 2	log(LR)
<input type="checkbox"/>	11PE00795	B8662A	11PE00795	B8759X	21.955
<input type="checkbox"/>	11PE00772	B8657X	11PE00772	B8784X	15.416
<input checked="" type="checkbox"/>	11PE00761	B8666M	11PE00761	B8810X	15.165
<input checked="" type="checkbox"/>	11PE00761	B8666M	11PE00761	B8815X	10.842
<input checked="" type="checkbox"/>	11PE00761	B8863M	11PE00761	B8819X	09.143
<input checked="" type="checkbox"/>	11PE00761	B8863M	11PE00761	B8815X	07.412
<input checked="" type="checkbox"/>	11PE00772	B8565X	11PE00772	B8784X	07.029
<input checked="" type="checkbox"/>	11PE00772	B8732X	11PE00772	B8784X	06.185

Between case

Select	Case 1	Item 1	Case 2	Item 2	log(LR)
<input type="checkbox"/>	10PE00285	B6931X	11PE00772	B8657X	08.013
<input checked="" type="checkbox"/>	10PE00285	B6930X	11PE00772	B8657X	07.543
<input checked="" type="checkbox"/>	10PE00285	B6990X	11PE00772	B8657X	05.772
<input type="checkbox"/>	10PE00285	B6931X	11PE00772	B8565X	04.779
<input type="checkbox"/>	10PE00285	B6931X	11PE00772	B8732X	03.670
<input type="checkbox"/>	10PE00285	B6990X	11PE00772	B8565X	03.206
<input type="checkbox"/>	10PE00285	B6990X	11PE00772	B8732X	03.014

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# More information

<http://www.cybergenetics.com/information>



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

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



Cybergenetics



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