COMMONWEALTH OF VIRGINIA V MICHAEL GARDNER

Dr. Mark W. Perlin
Cybergenetics, Pittsburgh, PA, USA

DNA evidence. Michael Gardner, a respected lawyer in Arlington, VA, was accused in June 2011 by three young girls of having molested them when they stayed overnight at his Falls Church home for his daughter's tenth birthday celebrations. Consistent with the allegations of inappropriate touching, no semen or other intimate biological evidence was found. However, some of the girls' clothing was collected, and analyzed for DNA by the state crime lab.

The inside crotch panel of one girl's underpants showed a two person DNA mixture. The analyst could not eliminate the girl or Mr. Gardner as contributors to this mixture, but was unable to calculate a CPI match statistic. The lab therefore sent the STR data (.fsa files) to Cybergenetics in Pittsburgh, PA to compute a match statistic using TrueAllele® computer-based probabilistic genotyping.

The computer interpretation was entirely objective, having no knowledge of reference genotypes, and thoroughly considered a hundred thousand candidate solutions. The computer mathematically separated the mixture data into major and minor contributors. The separation was virtually complete, producing two definite genotypes. Each genotype had a single-source appearance, with probability heavily concentrated on just one allele pair. Multiple computer runs reliably inferred concordant genotypes.

Match comparisons were made between the inferred mixture genotypes and the available reference genotypes. As expected, a genotype (major contributor) from the underpants matched the girl who was wearing them. Because of the complete mixture separation, the 75% single-source appearing genotype gave an exact match, yielding a single-source level match statistic of 363 quadrillion. (All statistics here are computed relative to a Caucasian population, with a 1% coancestry theta adjustment.) This genotype did not match the other girls or the suspect.

The minor contributor genotype from the underpants was compared with the references. The essentially complete mixture separation meant that comparison of this 25% genotype with any reference would either show (a) a very high RMP-like single-source statistic establishing a definite match, or (b) an equally strong match rejection. The minor genotype did not match the girls. However, the computer found that a match between the underpants and Mr. Gardner was 20 quadrillion times more probable than coincidence. There was little doubt but that Mr. Gardner's DNA was present on the interior of the victim's underwear.

Court presentation. The Gardner trial began on Monday, April 23, 2012. The three young girls each testified for about four hours that week, enduring long cross-examinations. The state DNA laboratory analyst presented the biological evidence. On Thursday morning, Cybergenetics Chief Scientist Dr. Mark Perlin was sworn in to testify about the TrueAllele computer DNA match statistics.

In a short PowerPoint presentation, the DNA expert witness first introduced the jury to STR genotypes and DNA evidence interpretation. He showed them a quantitative STR data signal (from the underpants at the Penta E locus), and explained how the computer separates DNA mixtures. Specifically, he described to them visually how the computer considers all possible

genotype solutions, giving higher probability to proposed peak patterns that better explain the observed peak height data.

The computer had objectively inferred an evidence genotype, determined solely from the data, without any knowledge of the suspect's genotype. Using bar charts, the expert witness visually explained the DNA match statistic, comparing the probability of the evidence matching the suspect (numerator) with coincidence (denominator); this ratio was around 30 at the Penta E locus.

The DNA expert showed a bar chart of the 15 independent locus match statistics Multiplying these numbers together answered the question "Is the suspect in the evidence?" with the statement "A match between the underpants and Mr. Gardner is 20 quadrillion times more probable than coincidence."

The cross-examination took under an hour, never seriously challenging the reliability of the computer's DNA interpretation or its match findings. The expert explained why the 20 quadrillion DNA match statistic was scientifically expected. Computer mixture separation into genotypes having single-source certainty yields match statistics having single-source magnitude.

The jury balanced Mr. Gardner's word against that of three fifth grade girls corroborated by DNA. On May 2, Michael Gardner was convicted of two counts of sexual battery and one count of object penetration. The jury sentenced him to 22 years in prison. ⌘