A142 Sherlock Holmes and the DNA Likelihood Ratio

Mark W. Perlin, PhD*, Cybergenetics, 160 North Craig Street, Suite 210, Pittsburgh, PA 15213

After attending this presentation, attendees will better understand the principles of reporting DNA match results using a likelihood ratio (LR). By framing the apparently obscure notions of the LR in a more accessible literary setting, forensic practitioners can develop increased comfort with this important reporting and testifying skill.

The presentation will impact the forensic science community by enabling practitioners to more comfortably use the LR in their DNA match reporting. Mastery of the LR principle is critical for reporting out the most informative results from complex DNA evidence. Society depends on this accurate LR information for apprehending and convicting criminals.

The principles of Bayesian inference (Bayes, 1763)[1] were well known to the Victorians (Jevons, 1874).[2] One master practitioner was detective Sherlock Holmes, who routinely employed a "balance of probabilities" to solve his fictional crimes (Doyle, 1890).[3] Holmes' deft use of the LR for weighing evidence (Good, 1950)[4] regularly astounded his compatriots. His clarifying insights into applied inductive logic are particularly relevant to the modern reporting of DNA evidence.

Chapter IV of the *"Hound of the Baskervilles"* (Doyle, 1902)[5] finds Holmes and his companions breakfasting at a London hotel. They are pondering the origin of a cryptic letter that warns the new Baskerville lord to stay away from his ancestral home, lest he too share the fate of his prematurely deceased predecessor. Holmes examines the handwritten address and announces that the letter was written in a nearby hotel. "Guesswork!" scoffs a skeptic. "Rather," rejoins Holmes, "we balance probabilities." His ensuing explanation is a lucid gem of likelihood clarity.

Sherlock Holmes' same Bayesian logic underlies the scientific reporting of DNA evidence. The identification hypothesis asserts that a suspect contributed his DNA to some biological evidence. The alternative hypothesis avers that someone else was the contributor. The LR balances the probability of the evidence assuming the identification hypothesis, relative to the data probability under the alternative hypothesis. The resulting weight of evidence provides an objective numerical LR match score that focuses on the data and factors away prior prejudices.

This presentation presents the LR concept through the investigative eye of Sherlock Holmes. The presentation will work through a literary case example, illustrating every step of the LR determination using words and pictures. These concepts will then be applied to the reporting of complex DNA evidence, such as DNA mixtures.

Forensic DNA is an information science, with the LR providing unifying information metric for all interpretation methods. Every valid DNA match score is a LR. This presentation advances practitioner understanding of the LR concept and facilitates its comfortable presentation in courtroom testimony.

References:

1. Bayes T. An essay towards solving a problem in the doctrine of chances. Phil Trans. 1763;53:370-418.
2. Jevons WS. The Principles of Science: A Treatise on Logic and Scientific Method. London: Macmillon & Co, 1874.
3. Doyle AC. The Sign of Four. London: Spencer Blacket, 1890.
4. Good IJ. Probability and the Weighing of Evidence. London: Griffin, 1950.
5. Doyle AC. The Hound of the Baskervilles. London: George Newnes, Ltd, 1902.

DNA Reporting, Likelihood Ratio, Testifying Skills