Beyond Newton's Law of Cooling Updated Methods for Estimating Time Since Death

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ABSTRACT

The relationship between body temperature and time since death has been noted for centuries. The earliest attempt to describe this relationship used the usually inaccurate formula of 1^{o}C per hour. The first scientific breakthrough occurred in 1868 when H. Rainey (*Glasgow Medical Journal*) applied Newton's Law of cooling to the relationship of deep inner body temperatures (rectal or liver temperatures) of deceased bodies. However, Rainey noted that during the first hours after death the rate of cooling is slower than the rate at later times. He described this phenomenon as a 'plateau.' It took almost an entire century until this problem was seriously approached by Marshall and Hoare in 1962 (*Journal of Forensic Science*) who proposed a double exponential model for making the estimate. This method has proved to be unwieldy and difficult to implement in the field because of the need for an extended period of accurate temperature observations. In 1988 Henssge (*Forensic Science International*) developed a nomogram based on the work of Marshall and Hoare for use in the field. This tool, though making the job easier, has had little acceptance because of the need to estimate body weight, weight of clothing, body position, and other factors. In 1985, Green and Wright (*Forensic Science International*) proposed another attack on the problem, which looks at the percentage of possible cooling done by the deceased's body. Their method requires only a two temperature measurements on the scene where the body is discovered. Despite all of these attempts at accuracy, many coroners still use the old 1^{o}C per hour rule.

In this presentation, an overview of using DERIVE® to explore the methods described above and compare their results using temperature data from actual coroner scenes. The presenter will also present a method that may be applied to situations where the body is located outdoors. This method will use daily temperature data and a minimum of body temperature measurements.

Keywords
Time since death, body temperature, ambient temperature, exponential models