Leinbach, Carl. 2011. Beyond Newton's law of cooling – estimation of time since death. *International Journal of Mathematical Education in Science and Technology*. 42(6): 765-774.

Article Abstract: The estimate of the time since death and, thus, the time of death is strictly that, an estimate. However, the time of death can be an important piece of information in some coroner's cases, especially those that involve criminal or insurance investigations. It has been known almost from the beginning of time that bodies cool after the internal mechanisms such as circulation of the blood stop. A first attempt to link this phenomenon to the determination of the time of death used a crude linear relationship. Towards the end of the nineteenth century, Newton's law of cooling using body temperature data obtained by the coroner was used to make a more accurate estimate. While based on scientific principles and resulting in a better estimate, Newton's law does not really describe the cooling of a nonhomogeneous human body. This article will discuss a more accurate model of the cooling process based on the theoretical work of Marshall and Hoare and the laboratory-based statistical work of Claus Henssge. Using DERIVE®6.10 and the statistical work of Henssge, the double exponential cooling formula developed by Marshall and Hoare will be explored. The end result is a tool that can be used in the field by coroner's scene investigators to determine a 95% confidence interval for the time since death and, thus, the time of death.

The author opens this article with the following, "There are many good approaches and styles for teaching mathematics. A favourite of the author is an approach that addresses the perennial questions about the utility of a topic prior to presenting the topic in its full-blown form. The logistics of this approach are to have students develop or see the development of a mathematical model that represents a familiar situation that they understand and may be curious about solving. Prior to the use of computer algebra systems (CASs), this meant that a great deal of background material had to be developed prior to addressing the problem being modelled. The CAS provides a bridge between the present state of the students knowledge and the tools needed to construct and use a model. This, of course, is not the end of the mathematical instruction. It provides a foundation for the process."

The paper offers an excellent history of temperature-based methods and then proceeds to demonstrate these with some data. Here the history is rich and will support student investigation as well as faculty development.

Keywords: Newton's law of cooling; double exponential model; Rainy plateau