New method could help estimate time of death for a ten-day-old corpse

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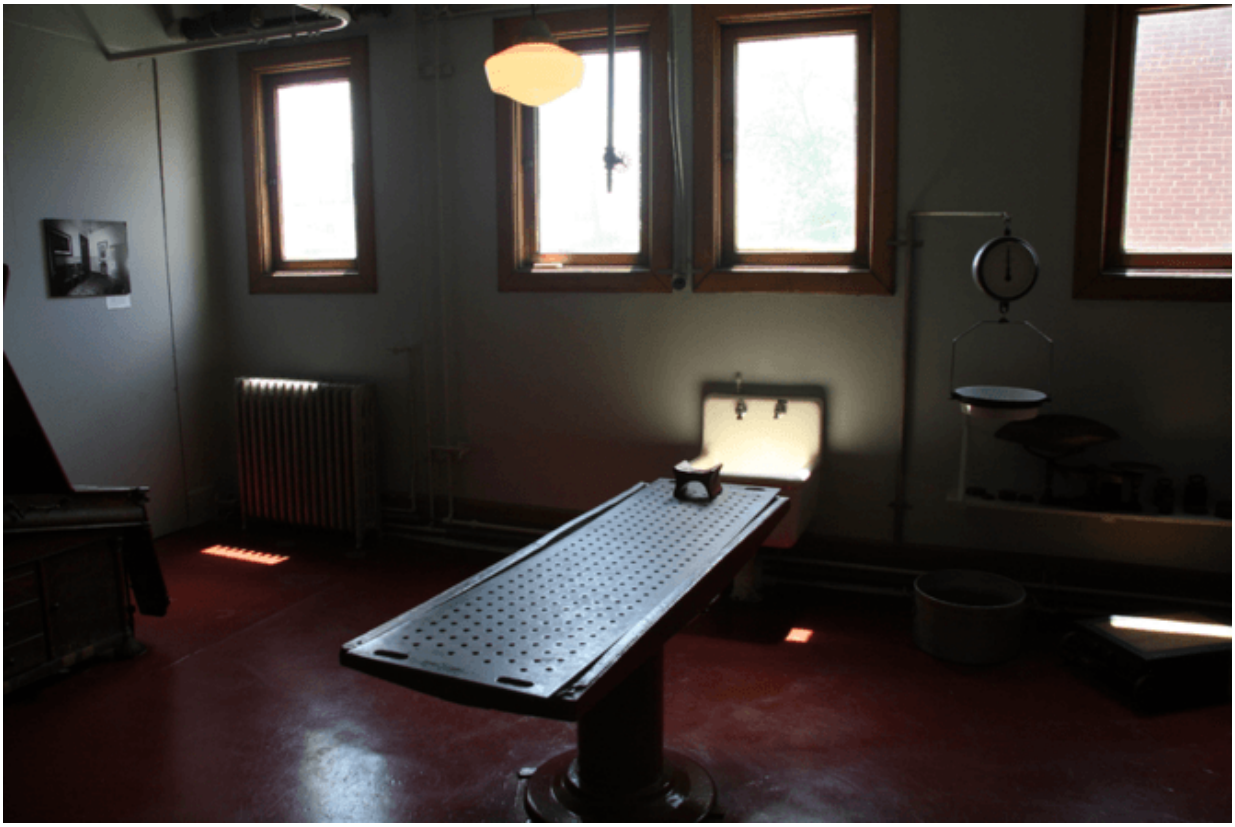

Old autopsy room at Indiana Medical History Museum. Credit: Huw Williams /wikimedia

In any murder investigation, one of the most crucial questions is when the victim died. Accurately pinning down the time of death helps

forensic teams to track down the whereabouts of their suspects – and whether they had an alibi.

Despite the value of this information, it is currently not possible to estimate time of death in a reliable way after about 36-72 hours. But now a new test for calculating the exact time of death after as many as ten days has been developed. However, the method, which works by tracking the degradation of protein in muscles, has only been tested in pigs so far.

In forensic investigations, the time since death is known as the post-mortem interval. Forensic pathologists can use the physical and chemical transformations that occur in the body after the death in order to estimate it.

The measure of body temperature is one of the most important indicators that forensic pathologists use to deduce the post-mortem interval. Other approaches include how much the blood has settled or how much the muscles have stiffened (an effect known as rigor mortis). However these factors are only useful until about 72 hours after the death.

In addition, the precision of the measurements depends on several factors related to the external environment – such as temperature or the exposure or concealment of the body. Other variables include body weight and the presence of wounds or pathologies on the body.

A lot of research is being carried out to improve such tests. One promising tool is the study of insects and their developmental stage, which is particularly useful in highly decomposed bodies. This is because insects colonise a body in predictable waves, so the study of insects on cadavers tells us something about the minimum time since death. Microbiome, the study of the succession pattern of

microorganisms like bacteria, is another up and coming approach.

Revolution or baby steps?

The new study looked at the degradation of the muscle proteins in pigs, the closest animal model to humans when it comes to post-mortem studies. We know that proteins degrade after death – this is already used to understand the tenderness of the meat served on our tables. But what was not known was the rate of the muscle protein degradation and how applicable it would turn out to be in the field of forensics.

The researchers used a method called gel electrophoresis, which can be used to separate proteins according to molecular size. In this way, they could track a number of proteins according to their sizes over time. They found that some proteins disappeared very soon after death (such as titin and nebulin), whereas others degraded more slowly (desmin and SeRca1). Some never degraded (a-actin and tropomyosi) – at least not within the 240 hours of the study. In this way, the team generated a completely new approach for determining time of death, and it worked for up to ten days after death.

The precision of this approach was surprisingly high. In certain cases, detecting how much a protein has broken down allowed time-of-death estimations within 8 hours. In other cases, however, the precision range was higher, around 24 hours.

However, the method is not yet ready to be introduced into real police investigations. The next step will be to transfer the information from the pig model to humans. However, that shouldn't take too long as there has been a surge in the number of volunteers that donate their body for forensic studies.

But there are also other variables that need to be considered. The study

did not take the effect of temperature and the age of the victim into account when tracking protein degradation. These are things that will have to be considered to develop a working method for real forensics teams.

But the study is still a big step forward in a rapidly evolving field. Combining this new method with standard time-of-death estimation, entomological evidence and microbiological clues will allow us to pinpoint the time of death of a person with a precision unbelievable few years ago – and it will do so in the very close future. The advances will significantly boost out chances to identify suspects and reducing judicial mistakes related to error in time estimations.

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