Advancing investigations of crime-related deaths in water

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Australian first research conducted at Murdoch University is advancing

the understanding of forensic investigations into crime-related deaths that have occurred in water bodies.

Led by Dr. Paola Magni, Senior Lecturer in Forensic Science at Murdoch University, the research performed in collaboration with the Murdoch University Algae R&D Center has investigated several methods for extracting Australian microalgae from four different common clothing fabrics, when investigating such deaths.

"Crime scene investigation protocols and procedures are well established when investigating crimes that have occurred within terrestrial environments," Dr. Magni said. "However, the protocols and procedures associated with crimes that have occurred in an aquatic environment are limited. Our research is looking at the idea that if someone commits a homicide drowning, the evidence able to connect the killer with the water body where the crime has been committed, can be found in the clothes of the killer. While drowning the victim, the killer wets their clothes with not just water, but with the plankton present in it. The plankton—especially microalgae such as diatoms—is specific for place and time therefore it becomes an incredibly useful micro-trace to frame the killer."

Dr. Magni said the research, conducted with Murdoch University colleagues, A/Prof Navid Moheimani and Dr. Ashiwin Vadiveloo, and Murdoch University honors student, Mohanaruban Mohan, was designed following a criminal case that Mr Magni was personally involved as expert witness.

"The killer is in prison for the next 30 years because of that," Dr. Magni said. "Over the years, there have been several methods proposed for the extraction of diatoms from clothing, however, a best practice method is yet to be established and is still open to debate. Crimes that occur in natural aquatic environments such as rivers and oceans, as well as in

places such as swimming pools show a greater complexity in physical and chemical dynamics when compared to terrestrial environments. It is important investigators maximize the preservation and collection of evidence from any crime scene, but there has been limited research and a lack of pre-established protocols for water-related crimes. In terms of the victim, one of the main issues occurring in aquatic environments is the scavenging action of fish and other animals. While consuming the body, the scavengers potentially destroy evidentiary material which is vital in estimating crucial information such as the cause and time since death occurred."

Dr. Magni said until a few years ago, individuals suspected of coming in contact with a water body in which a crime had occurred or a body was found could only be investigated on the basis of confessions, witness reports and/or circumstantial evidence.

"In order to overcome these investigative limitations, in the last few years scientists have investigated the possibility of using trace evidence related to the aquatic environment, for crime scene reconstruction," Dr. Magni said. "This idea stems from the forensic dogma that "every contact leaves a trace"—known as Locard's exchange principle. When a drowning occurs, for example, the subject inhales water and everything distributed in it, including diatoms. The pressure of the water in the lungs causes ruptures in the peripheral alveoli, and the water and its microscopic contents are transported into the blood, then to the heart, and other organs. The detection of diatoms in the brain, liver and bone marrow via a highly specific 'diatom test,' can therefore be used to support a crime scene reconstruction that sees the subject alive at their arrival into the water body, and a potential drowning. This is because only a functional respiratory and blood system would allow the diatoms to travel and reach such organs."

Dr. Magni said a match between the diatoms found in the organs with

that of the diatom assemblage present in the aquatic environment can establish if the death occurred in that particular water body.

"Moreover, if the same diatoms are present in the clothing of a suspect, they can be used for forensic crime scene comparison, to clarify the reconstruction of the events and the people involved."

Dr. Magni said the research would contribute towards informing investigators in the collection of evidence in water where a death occurred and the empirical approach that will enable evidence collected in the water where a death occurred to be accurately interpreted and presented in a court of law.

This is the first research of this type in Australia, and only four other research along this line have been published worldwide (in UK and the Netherlands).

More information: Paola A. Magni et al. Transferability of Australian diatoms to clothing: Assessment of several extraction methods on different fabric types under laboratory conditions, *Forensic Science International* (2020). DOI: 10.1016/j.forsciint.2020.110297

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