## H3 Ketamine and Blowflies: An Entomotoxicology Study

*Paola A. Magni, PhD*, Murdoch University, 90 South Street, Murdoch, Western Australia 6150, AUSTRALIA; Marco Pazzi, PhD, University of Turin, Dept of Chemistry, Via P. Giuria n.5, Torino, ITALY; Jessica Droghi, Street Diola 84/A, Vicobarone, Piacenza 29010, ITALY; Valentina Santoro, MSc, University of Turin, Dept of Molecular Biotechnology & Health Sciences, Via Nizza N 52, Torino 10126, ITALY; Marco Vincenti, MS, Centro Regionale Antidoping, Regione Gonzole 10/1, Orbassano, Torino 10043, ITALY; and Ian Dadour, PhD, Boston University School of Medicine, Program in Forensic Anthropology, Dept of Anatomy & Neurobiology, Boston, MA 02118*

After attending this presentation, attendees will understand the capability of entomotoxicology and how the presence of ketamine, (a medication mainly used as an anesthetic), commonly known as the drug used in facilitating sexual assault, can affect the survival, the size and the developmental rate of blowflies, which have a consequence on the estimation of the minimum Postmortem Interval (minPMI).

This presentation will impact the forensic science community by providing both chemical and entomological data that will be useful when determining the minimum time since death of human remains exposed to ketamine.

The branch of forensic entomology that studies insects used to detect drugs or other toxic substances in decomposing tissues is known as entomotoxicology. In the absence of tissues or biological fluids, insects developing on a human or animal cadaver present a reliable alternative for analysis of toxicological substances, especially because chemical methods validated for keratin substrates (e.g., hairs) can be generally applied to chitin, the exoskeleton of an insect.

The main focus of forensic entomology is the estimation of the minimum time since death of a deceased human or animal using the succession status of carrion insects, but in numerous studies it has been demonstrated that such time frames may be severely compromised by drugs and toxins. Therefore, entomotoxicology also investigates the effects of these substances on insect development, survival, and morphology. While the detection of drugs, metals, pesticides, and alcohol has been reported in entomotoxicological studies, only one incomplete study regarding the effects of ketamine on blow flies is available in the literature.

Ketamine is a medication mainly used for anesthesia in both humans and animals. Currently, ketamine has been used as a recreational drug, as well as a drug associated with sexual assault, and has been implicated in several deaths globally. To note, ketamine has also been implicated in the suspicious deaths of animals (e.g., fatal sedation due to a wrong dose of the drug).

The present study for the first time describes the development and the validation of two suitable analytical methods to detect ketamine in larvae, pupae, empty puparia, and adults of *Calliphora vomitoria* L. (Diptera: Calliphoridae). One method is based on Gas Chromatography/Mass Spectrometry (GC/MS), the second on High Performance Liquid Chromatography-Tandem Mass Spectrometry (HPLC-MS/MS). Furthermore, this study also considers the effects of ketamine on the survival, the developmental rate, and the morphology (length and diameter of pupae and larvae) of *C. vomitoria*.

*C. vomitoria* were reared on substrates (beef liver) spiked with two different concentrations of ketamine, a recreational use concentration (300ng/mg) and a concentration that could cause death in either a human or an animal (600ng/mg). Another untreated liver was used as control.

The results demonstrated that: (1) both the GC/MS and the HPLC-MS/MS methods are applicable in detecting ketamine in *C. vomitoria* because all the required parameters (linearity of method, coefficient of determination, detection limit, quantification limit, extraction recovery %, precision, selectivity, and carry over) were satisfied; (2) only the GC/MS method demonstrated positive results on *C. vomitoria* adults; (3) the presence of the two ketamine concentrations in the food substrate significantly modified the developmental time of *C. vomitoria* by slowing down the time to reach the pupal instar and the adult instar; (4) the survival of *C. vomitoria* is negatively affected by the presence of ketamine in the substrate; and, (5) the resultant lengths and diameters of larvae and pupae exposed to both concentrations of ketamine were significantly larger than the controls.

**Entomotoxicology, Ketamine, *Calliphora Vomitoria***