ABSTRACT

To ensure survival, prey animals instinctively process sensory cues to detect predatory threats, and transform this information into defensive actions. If animals correctly classify a cue as being harmless, this prevents them fleeing unnecessarily and allows them to forage and engage in other fitness-increasing behaviours. However, as the level of threat and potential for harm increases, they have to decide whether or not to seek safety.

Despite previous work on instinctive defensive behaviours in rodents, little is known about how the brain computes the level of threat for initiating escape. To address this, we developed an innate decision making paradigm in which a mouse detects and assesses sensory stimuli of varying threat evidence during exploration, choosing whether or not to escape to a shelter. In this talk, I will show that the behavioural statistics of escape in mice scales with the intensity of these innate threats, and can be described by a theoretical model that computes the distance between threat level and an escape threshold. I will present work using calcium imaging and optogenetics in the midbrain of freely behaving mice, as well as circuit mapping methods, that suggests how glutamatergic cells in the superior colliculus and periaqueductal gray are able to integrate and threshold threat information, and thus compute escape decisions.

REFERENCE:
Evans, D. A., Stempel, A. V., Vale, R., Ruehle, S., Lefler, Y., and Branco, T. (2018). A synaptic threshold mechanism for computing escape decisions. Nature 558, 590–594. https://www.nature.com/articles/s41586-018-0244-6