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Dr. Bronte Johnstone

Research Fellow, Ghosal Laboratory
Bio21 Institute, University of Melbourne

Dr. Bronte Johnstone is an early-career research fellow at Bio21 Institute, University of Melbourne (UoM). She received her PhD from UoM in 2022 under the supervision of Prof. Michael Parker, where her PhD studies focused on combining various structural biology methods to understand the structure and function of bacterial toxins. After her PhD, she completed a postdoctoral position in the Structural Virology lab at Monash University led by Prof. Fasséli Coulibaly. There she focused on using single-particle cryo-electron microscopy (cryo-EM) to uncover novel virus structures. In 2024, Bronte returned to UoM to join the laboratory of A/Prof. Debnath Ghosal to learn electron cryo-electron tomography (cryo-ET), which she is currently applying to study host-pathogen interactions.

Utilising cryo-EM and cryo-ET to investigate host-pathogen interactions mediated by membrane molecular machines

Interactions with the host-cell membrane are often crucial for successful infection or attack by a pathogen. These host-pathogen interactions lead to various outcomes such as pathogen entry, disruption of host-cell membranes or effector protein secretion. Cryo-EM has become a powerful tool to investigate host-pathogen interactions at unprecedented resolution. Single-particle analysis allows near-atomic resolution insight into large macromolecular membrane complexes, while cryo-electron tomography (cryo-ET) provides key insights into their mode of actions in a native cellular environment. Here, Bronte will provide two examples where she has used two different modalities of cryo-EM (SPA and cryo-ET) to study the molecular players involved in host-cell interactions in a membrane environment. She will discuss structural studies that uncovered the mechanism for pore-formation by a recently discovered family of bacterial toxins. To deduce the mechanistic pathway, they combined structures from X-ray crystallography with cryo-EM structures of an oligomeric intermediate and the membrane-embedded pore, solved on the surface of liposomes. This revealed detailed snapshots across the entire pore-forming pathway. Secondly, she will provide an example of a high-throughput cryo-ET workflow to study viral membrane fusion using an in vitro reconstitution system. This system, developed in the Ghosal lab, allows for visualisation of membrane fusion between virus and host-cell membranes at sub-nanometre resolution without biosafety hurdles or focused ion-beam (FIB) milling.