Mechanistic Insights into the Activation and Pore Formation of Insecticidal Proteins from Ferns

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Insecticidal proteins from *Bacillus thuringiensis* (*Bt*) have been the foundation of biological pest control for several decades. Their use in transgenic crops has substantially reduced reliance on chemical insecticides; however, long-term deployment has led to the emergence of resistant insect populations across multiple pest species. This growing resistance highlights the need for novel insecticidal proteins with distinct mechanisms of action. Recently, a new class of insecticidal proteins has been identified in ferns, including Fip_Cow from *Colysis wrightii*, which shares structural similarity with *Bt* Cry toxins. These proteins protect crops against *Bt*-resistant insects and therefore represent promising candidates for next-generation bioinsecticides.

Given its structural resemblance to *Bt* toxins, Fip_Cow is hypothesised to function as a pore-forming protein, although the molecular mechanisms underlying this process remain poorly understood. In its crystal structure and in solution, Fip_Cow forms a stable dimer, suggesting that activation involves structural rearrangement or dissociation. Ongoing work aims to characterise the activation and pore formation mechanisms of Fip_Cow through a combination of biochemical and structural approaches, including cryo-electron microscopy (cryo-EM). Together, these studies aim to establish the molecular basis of Fip_Cow toxicity and to provide broader insight into the mechanisms of this emerging family of fern insecticidal proteins.

Reference: Wei, J.Z. et al. (2023). Novel insecticidal proteins from ferns resemble insecticidal proteins from *Bacillus thuringiensis*. Proceedings of the National Academy of Sciences, 120(44).