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Honeybee Vaccination – from the lab to the field

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Insects lack antibodies, the key mediators of immunological memory that vertebrate mothers transfer to their offspring. However, empirical research has demonstrated that maternal exposure to pathogens can enhance the immune competence of insect progeny. The underlying mechanisms of this trans-generational immune priming, despite the absence of antibody-mediated immunity, have remained elusive. This study identifies vitellogenin, an egg-yolk protein, as the molecular conduit for immune priming in honeybees. Vitellogenin binds bacterial fragments and facilitates their transfer to developing eggs, thereby conferring pathogen-specific immune benefits to offspring.

This naturally occurring immunological mechanism provides protection against multiple pathogens, with findings indicating that honeybee queens, when orally exposed to pathogen-derived fragments, can augment the immune defenses of their progeny. Given that honeybees are susceptible to a wide range of infectious and often highly virulent diseases throughout their life cycle, the limitations of existing treatment approaches necessitate a paradigm shift in disease management. Conventional therapeutic interventions have frequently proven inadequate, resulting in substantial colony losses. Consequently, prioritizing honeybee health with the same rigor as other livestock is imperative.

A major advancement in this regard is the development of the first vaccine designed to mitigate the spread of Paenibacillus larvae, the causative agent of American Foulbrood (AFB). This conditionally licensed vaccine was introduced in the United States in December 2022 and has since been implemented in thousands of hives. The present study reports on the initial observations and experiences from the deployment of this innovation among beekeepers. The overarching objective is to decelerate and ultimately prevent the spread of this highly contagious bacterial disease while promoting a more sustainable and evidence-based approach to honeybee disease management.