

How Viruses Became One With Parasitic Wasps

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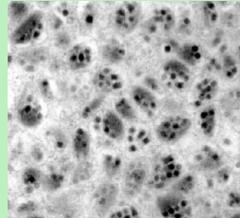
Introduction to Braconids

Braconidae is a family of parasitic wasps. Some braconids are endoparasitic, meaning they inject their eggs inside their host. Alongside their eggs, braconids inject viral particles into their host that alter its physiology to ensure a suitable habitat for the eggs. After their eggs hatch inside the host, the larvae eat their way to freedom (Herniou et al., 2013).

Kingdom	Animalia
Phylum	Arthropoda
Class	Insecta
Order	Hymenoptera
Superfamily	Ichneumonoidea
Family	Braconidae



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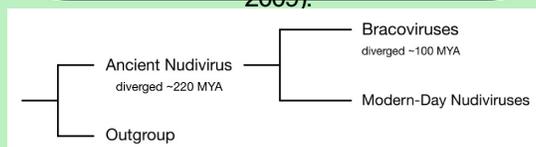
Viral Particles

Through electron microscopy, dark, viral particles can be seen inside the ovarian cells of braconids. These are the viruses, known as **bracoviruses**, that are injected into the host.

Evolutionary Implications

Bracoviruses are unable to self-replicate because they lack the genes needed to produce structural proteins. Instead, these genes are located within the braconid genome, meaning that the wasps produce the proteins needed for viral replication. The viruses rely on the wasps to replicate, and the wasps rely on the viruses to parasitize their hosts: a symbiotic relationship (Strand and Burke, 2015).

Both the bracovirus and parts of the braconid genomes resemble those of nudiviruses, another group of viruses. Due to this association, it is hypothesized that an ancient species of nudivirus integrated into a chromosome of an ancestral wasp about 100 million years ago. Today's bracoviruses are derived from this early nudivirus, putting them in the Nudiviridae family. Other families of parasitic wasps may be in symbiosis with different descendants of the same nudivirus (Bezier et al., 2009).



Bracovirus Phylogeny, Adapted from Theze et al. (2011)

Sources

Bezier, A. et al. 2009. Polydnviruses of braconid wasps derive from ancestral nudivirus, 926-930. *Science*, 323.

Herniou, E. A., Huguet, E., Theze, J., Bezier, A., Periquet, G., and Drezen, J. 2013. When parasitic wasps hijacked viruses: genomic and functional evolution of polydnviruses. *Philosophical Transactions of the Royal Society of London*, 368.

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Theze, J., Bezier, A., Periquet, G., Drezen, J., and Herniou, E. A. 2011. Paleozoic origin of insect large dsDNA viruses, 15931-15935. *Proceedings of the National Academy of Sciences of the United States of America*, 108.