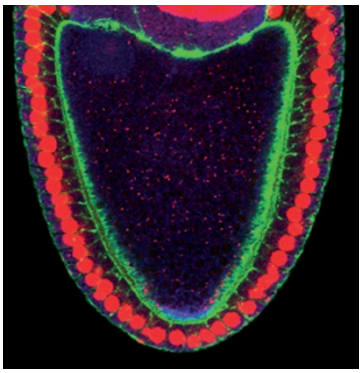
BACTERIAL PATHOGENESIS

Chain of transmission

New clues as to how *Wolbachia* spp. ensure their efficient vertical transmission through the host arthropod maternal germline have been revealed in a recent publication in *PLoS Pathogens*.

In arthropods, the transmission of *Wolbachia* spp. through the maternal germline is ensured by their incorporation into the germline precursor cells that are known as pole cells. Previous work had shown that during early–mid oogenesis in *Drosophila melanogaster*, the *Wolbachia pipientis* wMel strain (wMel) associates with oocyte microtubules and the bacteria localize at the oocyte anterior. During the later stages of oogenesis, however, *Wolbachia* spp. localize to the oocyte posterior, where pole-cell formation takes place.

Laura Serbus and William Sullivan began their investigations into the molecular mechanisms of posterior localization by treating *D. melanogaster* oocytes with microtubule inhibitors, which confirmed that host microtubules are involved. As the microtubule motor protein kinesin-1 is known to be present in the oocyte posterior, the authors created *D. melanogaster* oocytes that had a null mutation in the gene encoding kinesin-1, and found that in late-stage kinesin-mutant oocytes the posterior localization of wMel was disrupted.



Wolbachia pipientis bacteria are shown concentrating with the pole plasm at the posterior of a *Drosophila melanogaster* oocyte. Red labelling indicates the nuclei of surrounding cells (large circles) and *W. pipientis* in the oocyte (smaller puncta). The cell boundaries are indicated in green, and the pole plasm is shown in blue. Image kindly provided by Laura Serbus and William Sullivan, University of California, San Francisco, USA.

The authors speculated that kinesin-1 might transport the bacteria to the oocyte posterior as a cargo, possibly by 'hitchhiking' on other cargoes. One cargo of interest was the posterior germline determinant *oskar* (*osk*) mRNA. Once in the oocyte posterior, *osk* mRNA induces the formation of pole plasm, which specifies the fate of posterior pole cells. Serbus and Sullivan created oocytes in which *osk* and the gene encoding the *osk*-associated protein Staufen (*stau*) were disrupted. They found that wMel was depleted or absent from the posterior cortex in these mutants, but the distribution of bacteria in the cytoplasm was homogeneous. Taking these data together with other results, the authors propose a two-step model for wMel localization — the bacteria are transported to the oocyte posterior by kinesin-1 and are then anchored in position by the pole plasm. Further work that involved a comparison between different *Wolbachia* spp. strains revealed that factors that are intrinsic to *Wolbachia* spp. are also involved.

So, in common with many other bacterial and viral pathogens, it seems that *Wolbachia* spp. can manipulate host microtubules to achieve an advantageous position within host cells.

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ORIGINAL RESEARCH PAPER Serbus, L. R. & Sullivan, W. A cellular basis for *Wolbachia* recruitment to the host germline. *PLoS Pathog.* **3**, e190 (2007)