Study clarifies role of bacteria in pandemic diseases

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(Phys.org) —Wolbachia are intracellular bacteria that infect invertebrates at pandemic levels, including insects that cause such devastating diseases as Dengue fever, West Nile virus, and malaria. While Wolbachia-based technologies are emerging as promising tools for the control of the insect vectors of these deadly diseases, the processes underlying Wolbachia's successful propagation within and across species remain elusive.

A new study by CAS researchers sheds light on some of these processes by providing evidence that Wolbachia target the ovarian stem cell niches of its hosts—a strategy previously overlooked to explain how Wolbachia thrive in nature. The study, "Evolutionarily conserved Wolbachia-encoded factors control pattern of stem-cell niche tropism in Drosophila ovaries and favor infection," has been published in the current issue of *PNAS Early Edition*, available online here. Michelle Toomey, a CAS Biology PhD student, and Kanchana Panaram, a former postdoctoral fellow in the Frydman Lab at the Department of Biology, are the study's co-first authors.

Although Wolbachia are mainly vertically transmitted (from the parental generation of the species to the offspring), there is also evidence of extensive horizontal transmission (from one individual to another in the same generation). The study shows that both vertical and horizontal transmission occurs through Wolbachia's preference for the region of the insect ovary that contains stem cells, known as "stem cell niches". Tropism—in which different viruses or pathogens evolve to

preferentially target specific cell types within a host—for stem cell niches is pervasive in Wolbachia that infect the Drosophila (fruit fly) genus.

Using cell biological, phylogenetic, genetic, and transinfection tools, the BU team found evidence that stem-cell niche tropism is an evolutionarily conserved mechanism for Wolbachia hereditary and non-hereditary transmission, and that this tropism is a widespread occurrence across the Drosophila genus. Phylogenetic analyses also revealed selective pressures promoting strong conservation of the same pattern of niche tropism among closely related Wolbachia strains. Using hybrid crosses and transinfection experiments, the researchers demonstrated that Wolbachia-encoded factors, rather than the host genetic background, are the major determinants of different patterns of stem cell niche tropism.

"Because Wolbachia are maternally transmitted, their presence in the germ line is essential for their vertical propagation to the next generation," says Toomey. "However, Wolbachia are often found in several somatic tissues as well, and this distribution varies among different Wolbachia–host associations."

The study indicates it is easier for Wolbachia to reach the germ line through the stem cell niches during vertical transmission and probably during horizontal transmission as well.

"Wolbachia represent the first reported case of bacteria living in a stem cell niche. The data presented in this study provide the foundation for future methodologies toward the identification of genetic pathways mediating Wolbachia's stem-cell niche tropism in hosts," says Horacio Frydman, assistant professor of biology. Understanding the basis of Wolbachia targeting of specific tissues in the host and its consequences toward bacterial transmission will provide further insight into their extremely successful propagation and help identify new Wolbachia-

based vector control approaches.

More information: www.pnas.org/cgi/content/short/1301524110

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