STANDARD DEVIATIONS: The Other Side of the Story

Greetings,

Last week we looked at the impressive findings in Java where introducing a bacterium into the biome of a mosquito, effectively impeded its ability to infect humans with viruses such as dengue, chikungunya, and Zika.

Recall that the bacteria, *Wolbachia*, is not common to *Aedes aegypti*; but by manipulating the breeding, the resulting live offspring all carry the bacteria and are greatly diminished in their ability to propagate virus. Initial findings have shown dramatic decreases in viral incidence where the *Wolbachia* mosquitos are introduced (up to ~80% fewer infections).

Well, I told you that story in order to tell you this one.

Could this plan backfire? Is it possible that our machinations with the species could create a **Frankenstein** mosquito? What if *Wolbachia* infected *Aedes* differentiate into a new mosquito that presents a new unique threat?

It turns out that *Wolbachia* is already being shown to drive speciation. Studies in a genus of wasp, *Nasonia*, suggest that a host organism's microbes might trigger changes in mating and reproduction that begin to define two different populations.

{Scanning EM of *Nasonia*}

Two closely related species, *N. giraulti* and *N. longicornis*, can mate but offspring are not viable; they all carry symbiotic *Wolbachia*.

{Normal, top, and hybrid, non-viable *Nasonia* larvae}

However, if the wasps are treated with antibiotics, and their biomes are depleted of *Wolbachia*, the resulting offspring appear normal. Researchers theorized that different types of *Wolbachia* divided the parent species into two groups that were unable to interbreed — the traditional definition of a new species.

Now, thousands of insect species maintain a symbiotic relationship with *Wolbachia*. This implies that the biome could be major player in the development of species. The microbes we tolerate for the benefit of both (symbiosis) may drive a wedge that divides a common ancestor into multiple species.

Just insects? Hardly. Consider two hyenas, the striped and spotted species that live side-by-side on the savannah.

Both species communicate information on sex and reproductive status via a complex combination of volatile chemicals found in the stinky paste extruded from scent glands near the anus. It has been shown that their biomes are responsible for the chemical composition of the scents hyenas use to communicate. Ongoing studies imply that the biome is manifesting changes in social behaviors, as well.

Empirical evidence is mounting that microbes are integral to what it means to be who we are. Our symbiosis pushes evolution. Mitochondria in animals and chloroplasts in plants are vestiges of microbial endosymbionts that, in exchange for a home, perform vital functions for their hosts, generating power, protecting them from pathogens, producing essential amino acids, processing food, and even altering social behavior.

The effects of *Wolbachia* on *Aedes aegypti* are evident in reducing its ability to carry and transmit virus. The downstream consequences may be more far reaching than anyone anticipates. If we change the mosquito's behavior, range, pathogen capacity, or reproductive status we introduce unknowns to its evolution. By-passing evolutionary hurdles with our species manipulations may create new hazards that we haven't begun to consider.

Have a great week and be safe,

Bryan