PMI 214 Notes - Michael Turelli

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- Biocontrol of a human disease by blocking spread of Dengue through transmission of Wolbachia in Aedes aegypti
- Wolbachia are in about half of all insects
- Wolbachia can only survive in invertebrates - our immune system takes care of Wolbachia
- Wolbachia blocks Zika, Dengue, Chikun, Yellow Fever
- On an evolutionary time scale, Wolbachia moves between species
- Phylogenies of Wolbachia and radically different than the phylogenies of the insects they inhabit
- Cytoplasmic incopatability means females have a fitness advantage if they have Wolbachia
  - Incompatible cross is uninfected female with infected male – results in reduced number of offspring, all uninfected
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$$p_{t+1} = \frac{p_t(1-s_f)}{1-s_f p_t - s_h p_t(1-p_t)}$$

  where

  - p_t is the freq. of infected adults in gen. t
  - $H = 1 - s_h$ is the relative hatch rate from incomatible fertilizations
  - $F = 1 - s_f$ is the relative fecundity of infected females (conjecture)
- CI causes bistability - an unstable equilibrium at $\hat{p} = {}^{s_f}/_{s_h}$
- Turelli worked on overlapping generations in 2010
- add imperfect maternal transmission to the model: μ is the fraction of uninfected ova produced by infected females.
- The spread of Wolbachia was because of CI in spite of the decrease in fitness caused by Wolbachia.
- People were excited about using Wolbachia as an engine to move trans genes through populations
- HOWEVER, more Wolbachia were found which did not have CI and still spread. This means Wolbachia can be intrinsically beneficial to the insect. This means natural populations are Fisherian, not Bartonian, waves. The unstable equilibrium is at 0.
- Somehow, natural infections of Wolbachia have a net positive impact on fitness. Choosing an arbitrary Wolbachia with an insect creates Bartonian waves (since it hasn't "gone through the sieve of natural selection"). Fisherian waves (unstable point of 0) travel a thousand times faster than Bartonian waves.