BIO4AE3
3 Oct 2023

within-host dynamics.

use the ideas of ecological population dynamics to understand infectious disease at the individual level.

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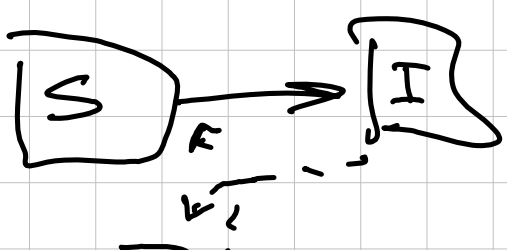
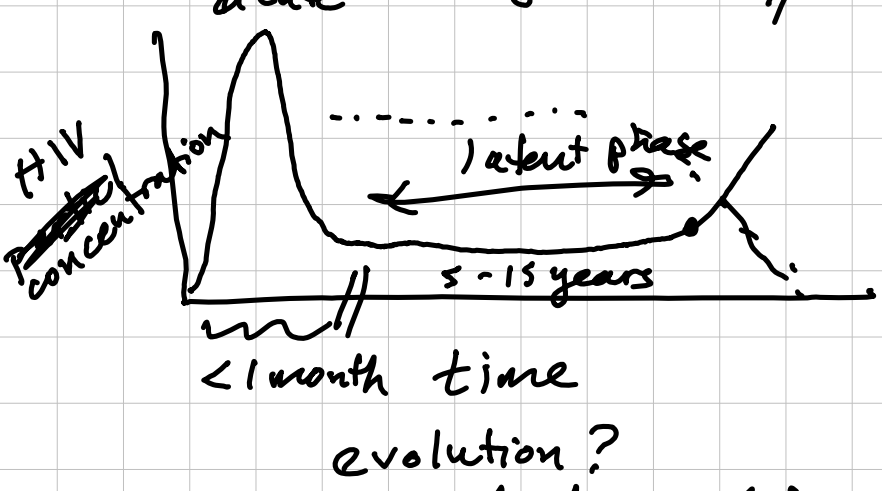
R_0 ?



HIV → progression ?



evolution?
gradual decay of immune system?

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early treatments for HIV (antiretroviral therapy) quickly gave rise to resistant viral strains

HIV - huge mutation rate
huge turnover.

→ EVERY possible point mutation rate occurs within a short time scale.

→ Cocktails to prevent resistance

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early treatments did rapidly generate resistance but resistant mutants were 'worse' (less fit, lower R_0) than WT

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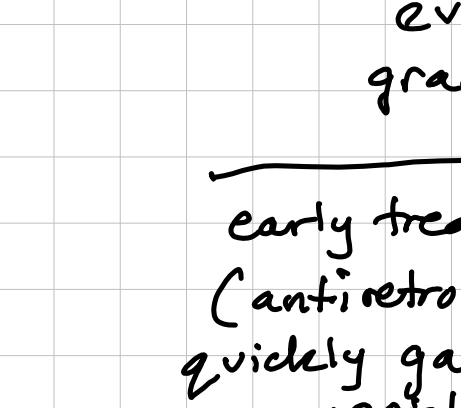
resistance always has a fitness cost (in the absence of drug treatment)

In the presence of drug
WT fitness → 0
resistant fitness < original WT fitness



$$\frac{dC}{dt} = \lambda - \mu C - \beta CV$$

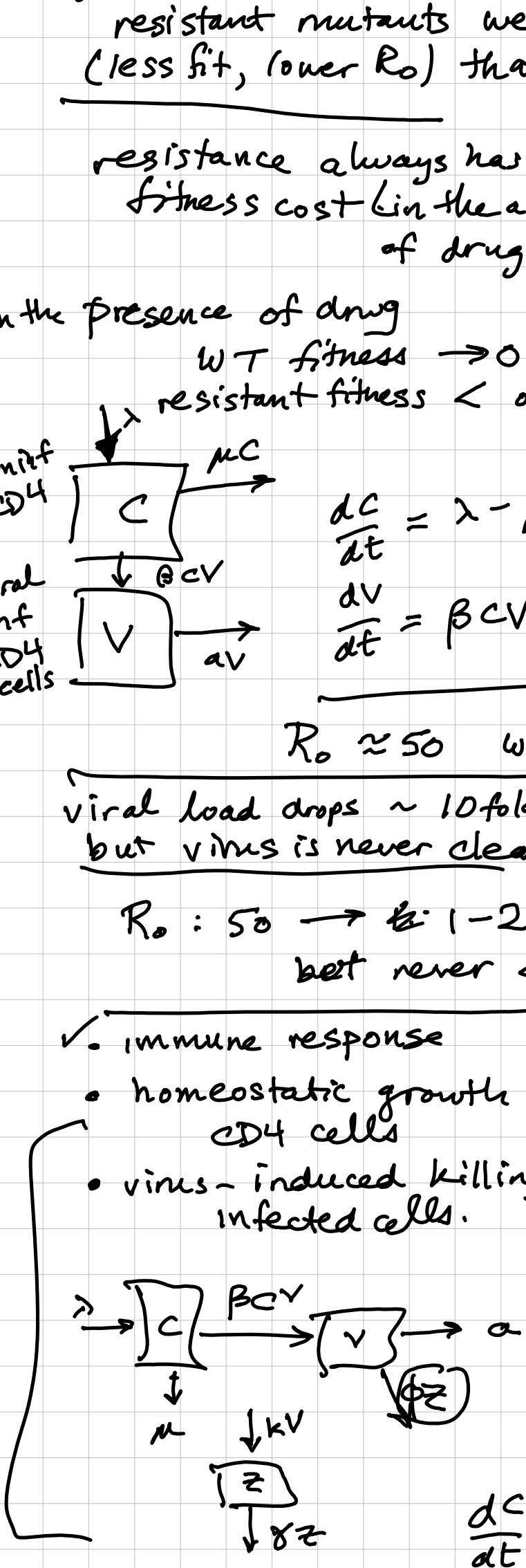
$$\frac{dV}{dt} = \beta CV - aV$$

$R_0 \approx 50$ WT

viral load drops ~ 10fold.
but virus is never cleared/cure

R_0 : 50 → ≈ 1-2
but never < 1

✓ • immune response
• homeostatic growth of CD4 cells
• virus-induced killing of infected cells.



$$\frac{dC}{dt} = \lambda C$$

vs $$\frac{dC}{dt} = \lambda C\left(1 - \frac{C}{K}\right)$$