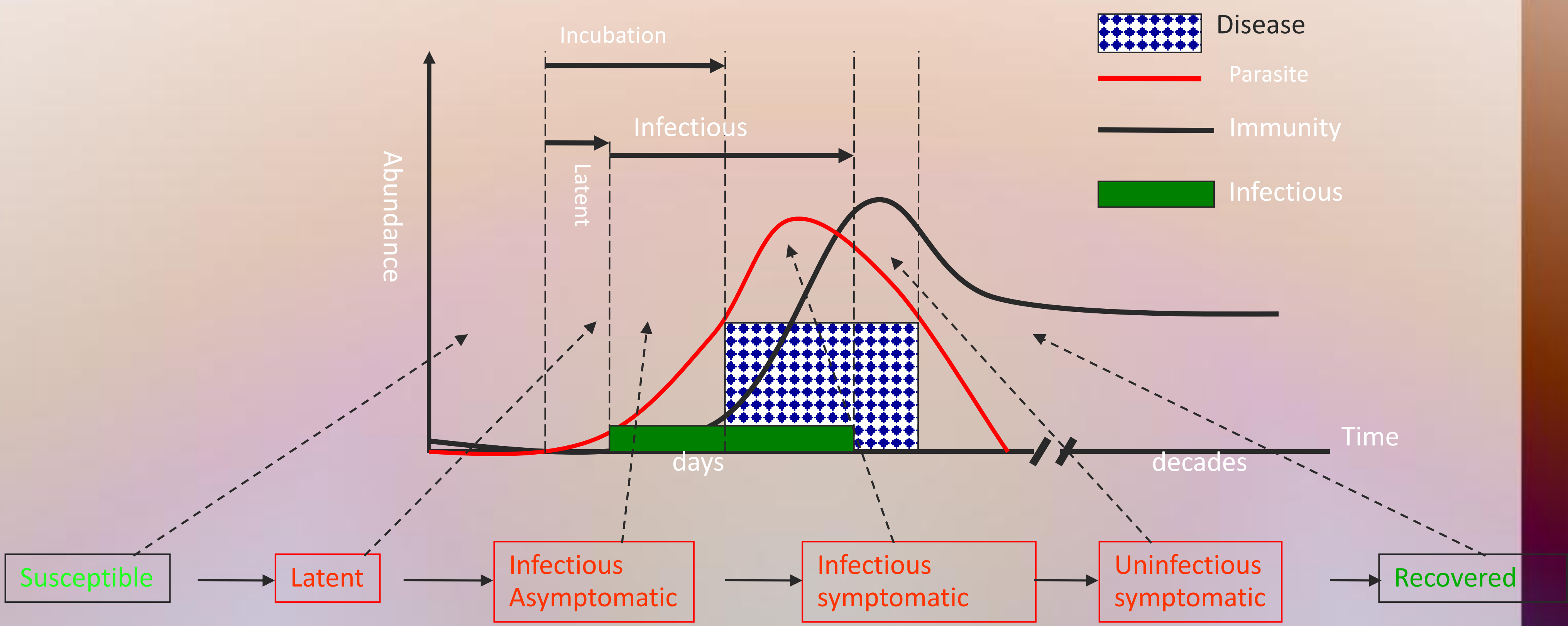
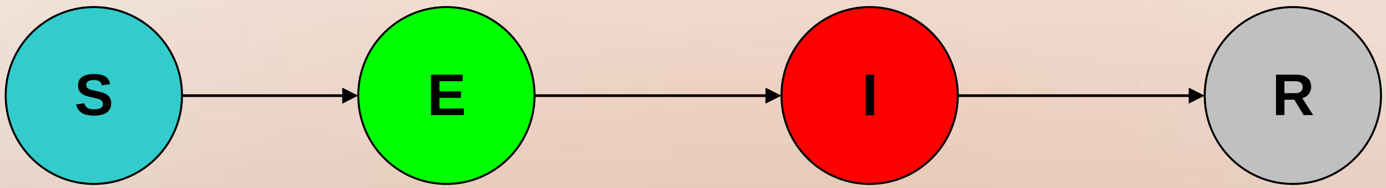
Infection trends



What do you think of such an approach?
What suggestion can you make?

The SEIR framework for microparasite dynamics



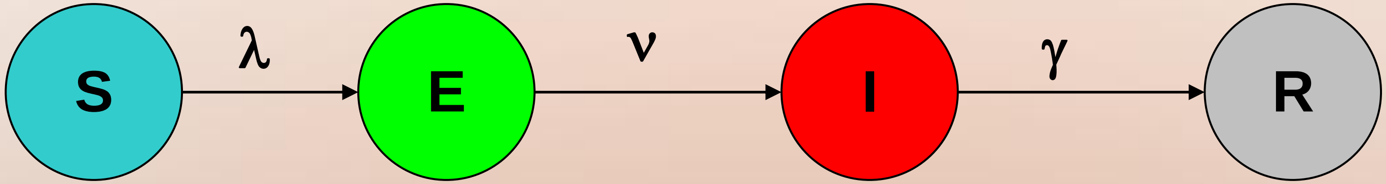
Susceptible: naïve individuals, susceptible to disease

Exposed: infected by parasite but not yet infectious

Infectious: able to transmit parasite to others

Removed: immune (or dead) individuals that don’t contribute to further transmission

The SEIR framework for microparasite dynamics



λ "Force of infection"

= βI under density-dependent transmission

= $\beta I/N$ under frequency-dependent transmission

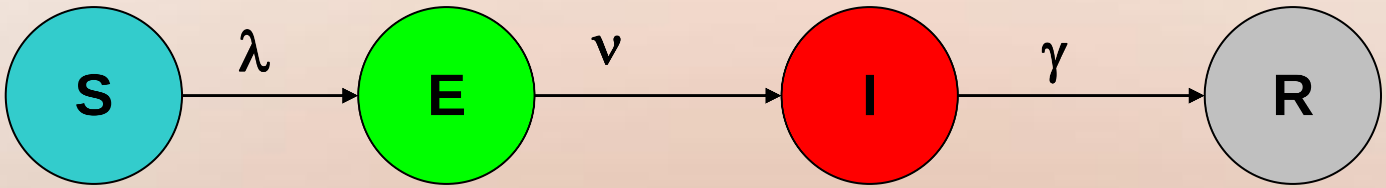
ν Rate of progression to infectious state

= 1/latent period

γ Rate of recovery

= 1/infectious period

The SEIR framework for microparasite dynamics



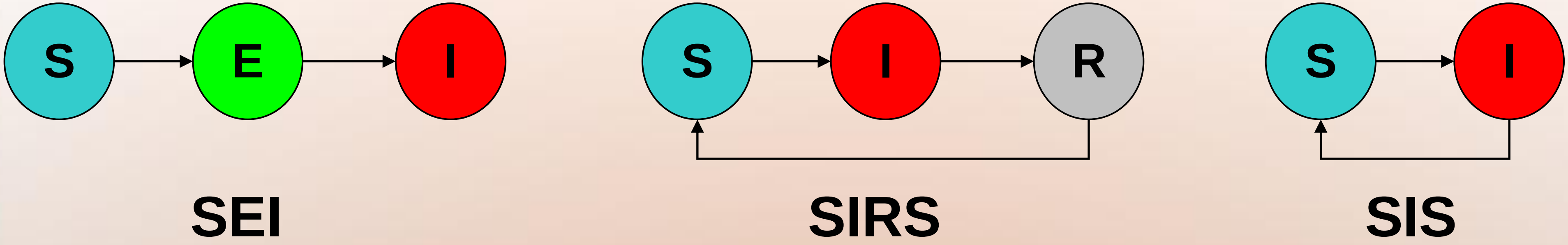
$$\frac{dS}{dt} = -\frac{\beta SI}{N}$$

$$\frac{dE}{dt} = \frac{\beta SI}{N} - \nu E$$

$$\frac{dI}{dt} = \nu E - \gamma I$$

$$\frac{dR}{dt} = \gamma I$$

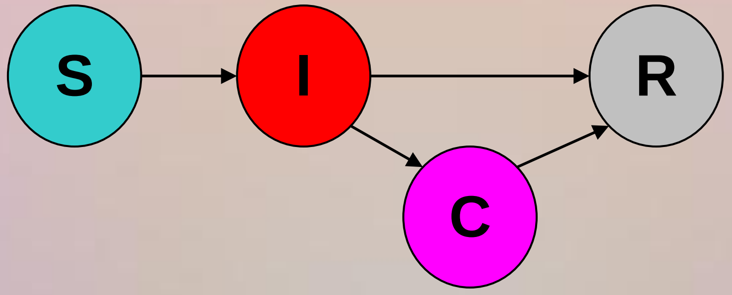
Ordinary differential equations are **just one approach** to modelling SEIR systems.



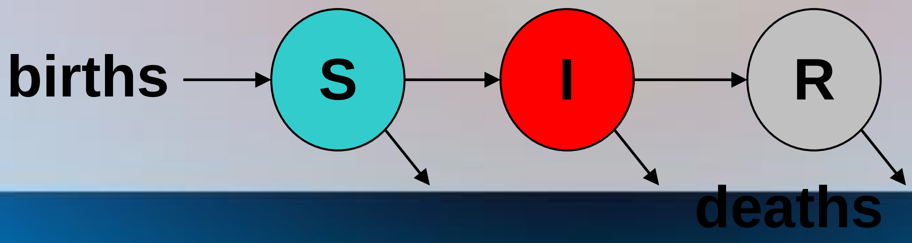
Adapt model framework to disease biology and to your problem!

No need to restrict to SEIR categories, if biology suggests otherwise.

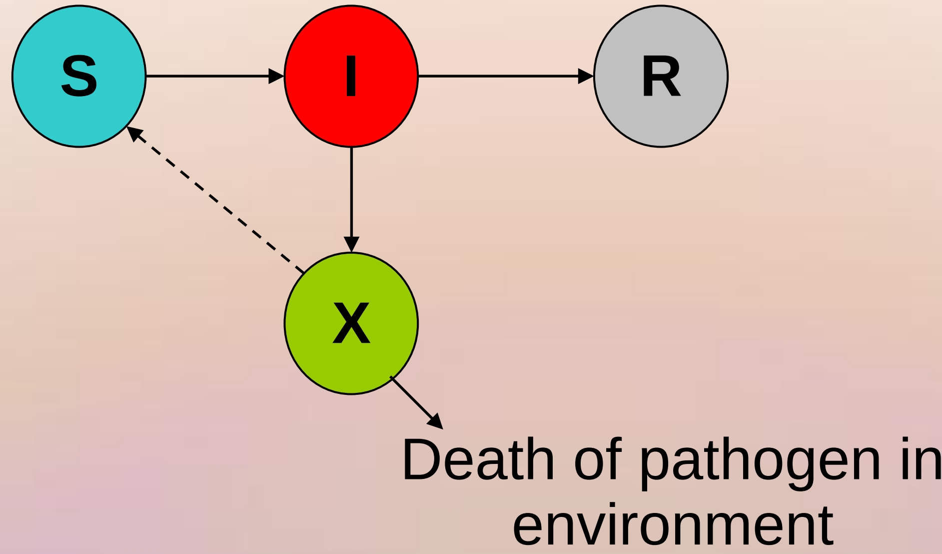
e.g. leptospirosis has chronic shedding state → SICR



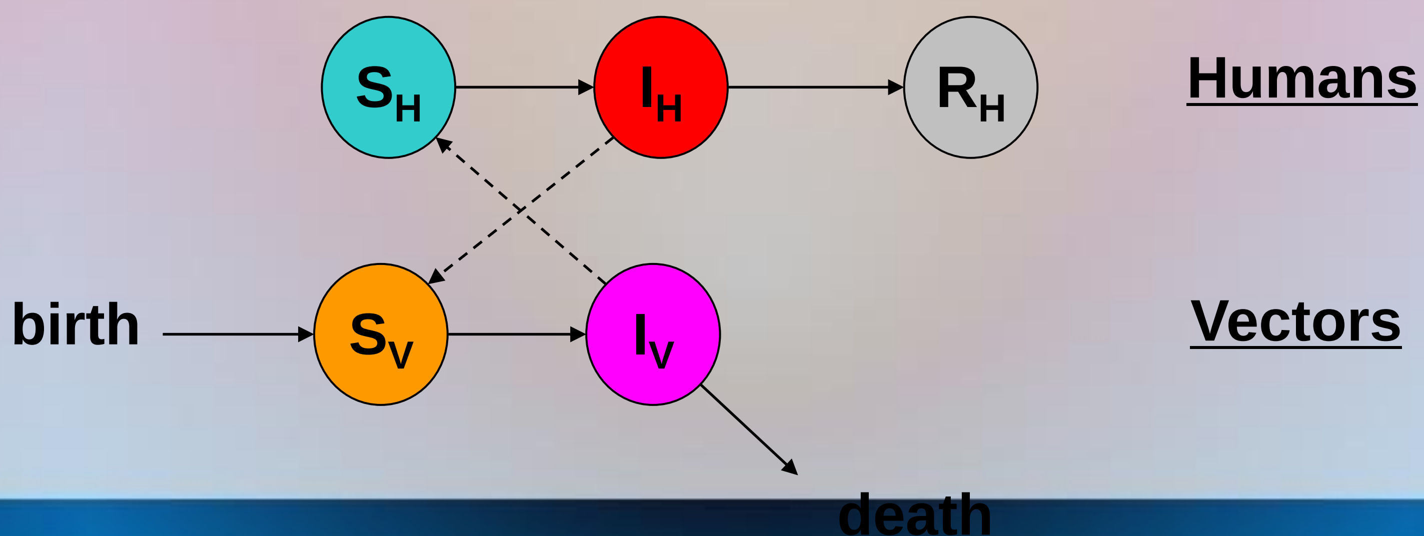
Depending on time-scale of disease process (and your questions), add host demographic processes.



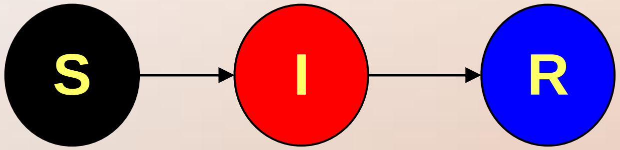
Disease with environmental reservoir (e.g. anthrax)



Vector-borne disease



SIR output: the epidemic curve



$$\frac{dS}{dt} = -\frac{\beta SI}{N}$$

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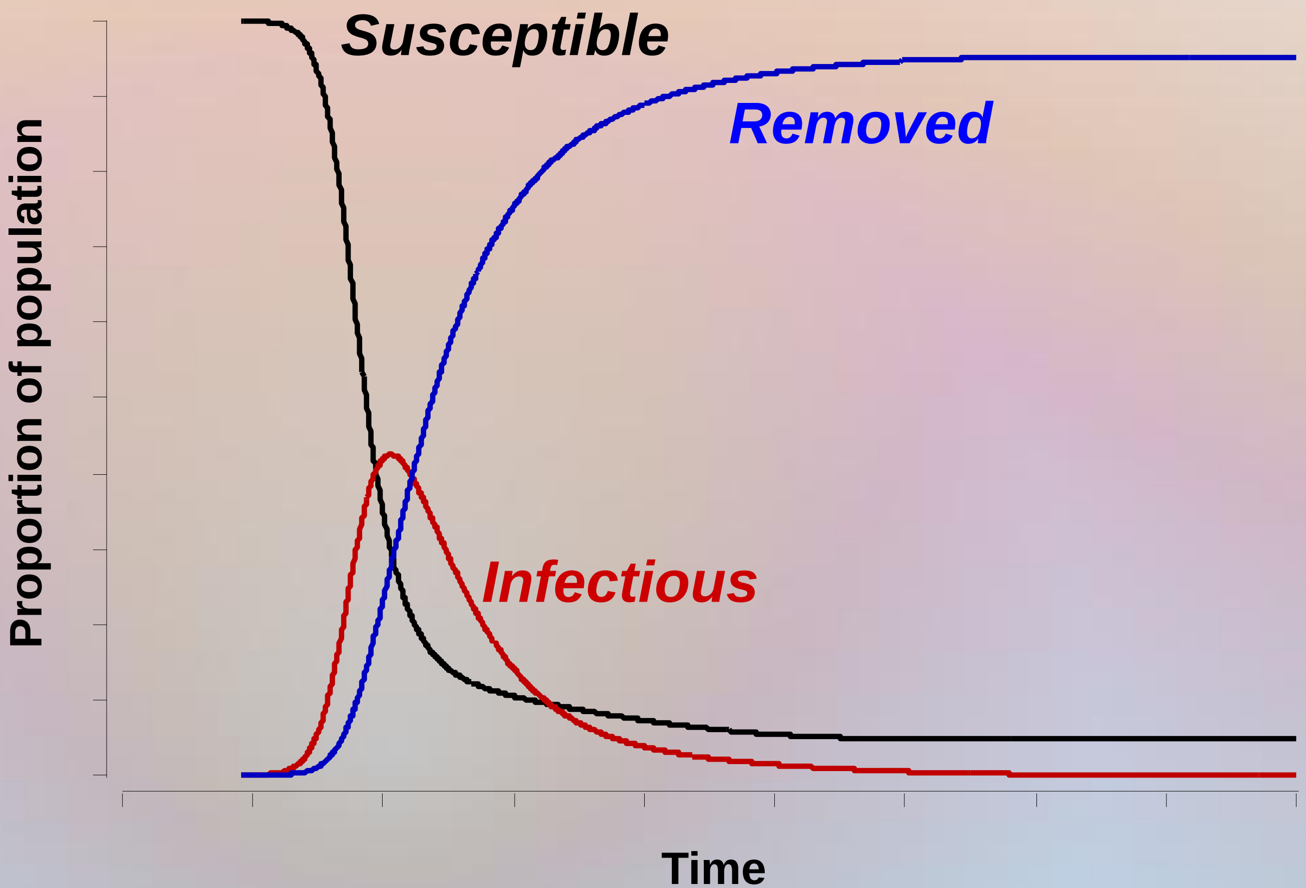
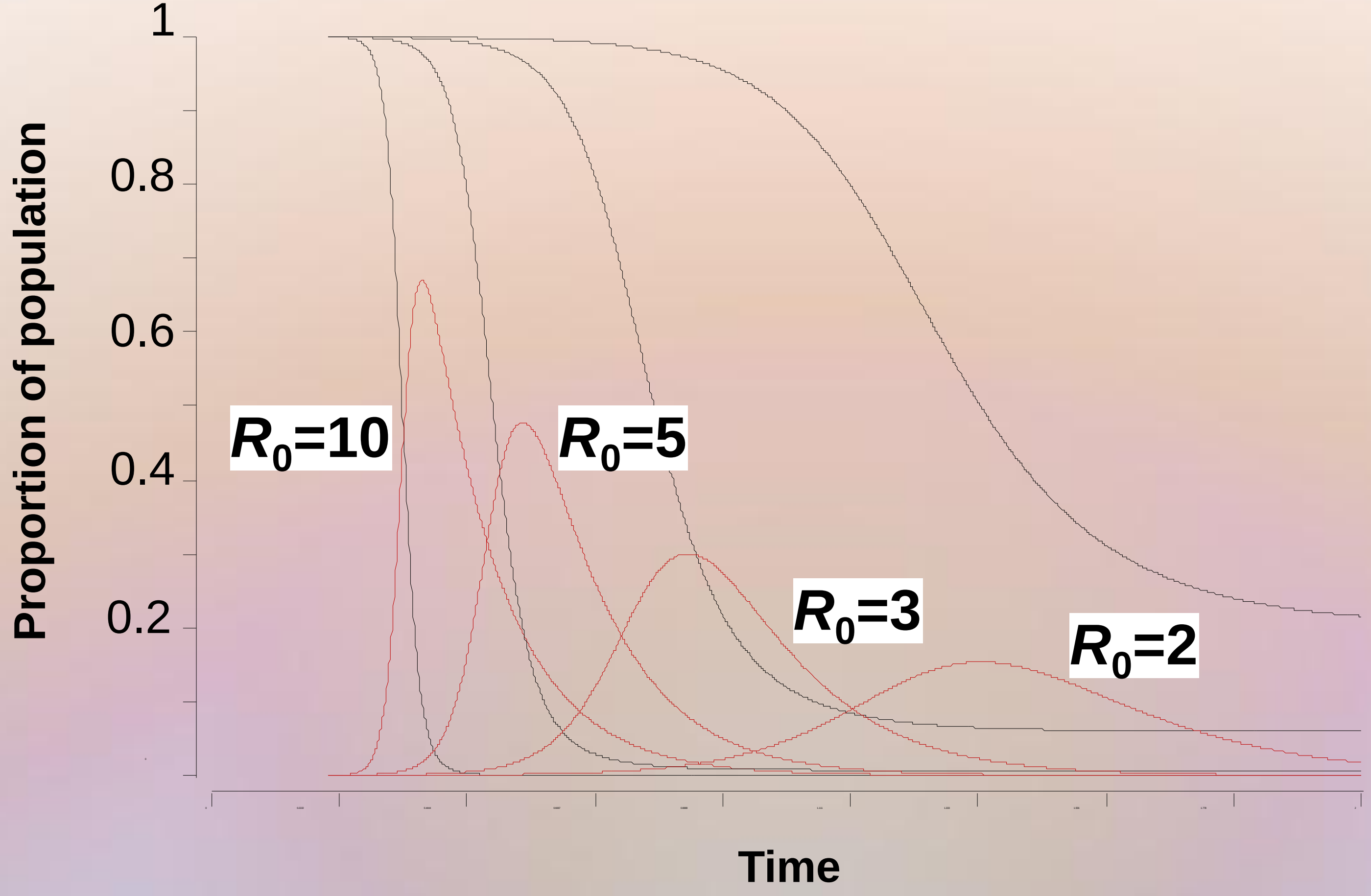
$$\frac{dR}{dt} = \gamma I$$



SIR output: the epidemic curve



Basic model analyses (Anderson & May 1991):

Exponential growth rate, $r = (R_0 - 1)/D$

Peak prevalence, $I_{max} = 1 - (1 + \ln R_0)/R_0$

Final proportion susceptible, $f = \exp(-R_0[1-f]) \approx \exp(-R_0)$

SIR output: stochastic effects