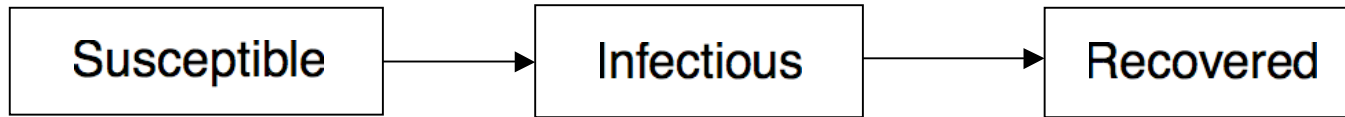


# SIR Epidemic Model

“First the doctor told me the good news; I was going to have a disease named after me.” Steve Martin

# SIR Model

Compartment Model:



Initial Model:  $\beta$ : contact rate,  $\nu$ : recovery rate

$$\frac{dS}{dt} = -\beta IS$$

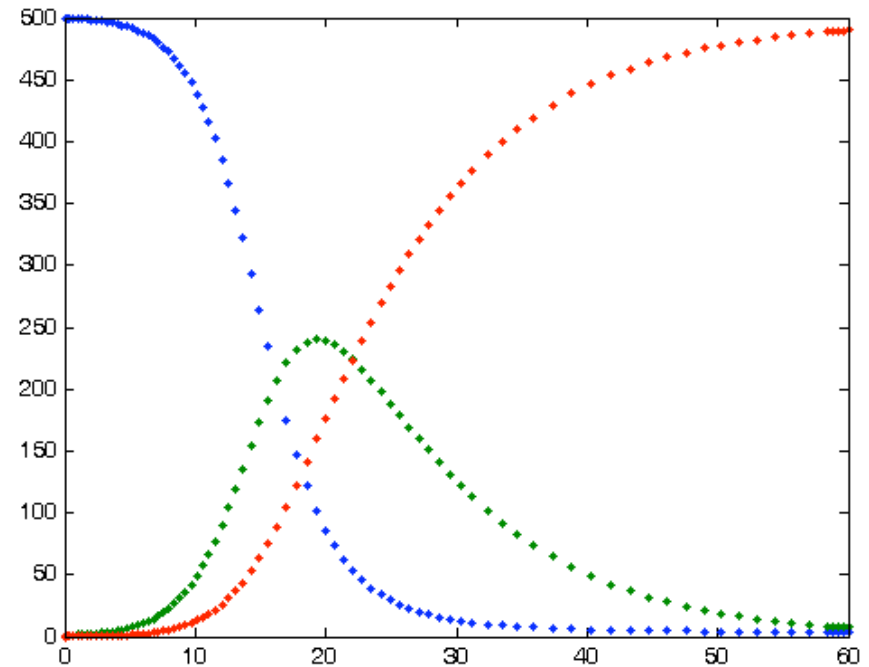
$$\frac{dI}{dt} = \beta IS - \nu I$$

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

Note:

$$\frac{dS}{dt} + \frac{dI}{dt} + \frac{dR}{dt} = 0$$

$$\Rightarrow S(t) + I(t) + R(t) = N(t)$$



# SIR Model

**SIR Model:** Include vital dynamics and constant population

$$\frac{dS}{dt} = \mu N - \mu S - \beta \frac{I}{N} S$$

$$\frac{dI}{dt} = \beta \frac{I}{N} S - (\nu + \mu) I$$

$$\frac{dR}{dt} = \nu I - \mu R$$

**Note:**  $\mu$ : Death and birth rate,  $\beta \frac{I}{N}$ : Infection rate