

$$\frac{\partial S}{\partial t} = -\beta SI$$

$$\frac{\partial I}{\partial t} = (1 - q)\beta SI - pI - \gamma I$$

$$\frac{\partial Q}{\partial t} = q\beta SI + pI - \gamma' Q$$

$$\frac{\partial R}{\partial t} = \gamma I + \gamma' Q$$