# How to solve mathematical modelling

## Lesson 7

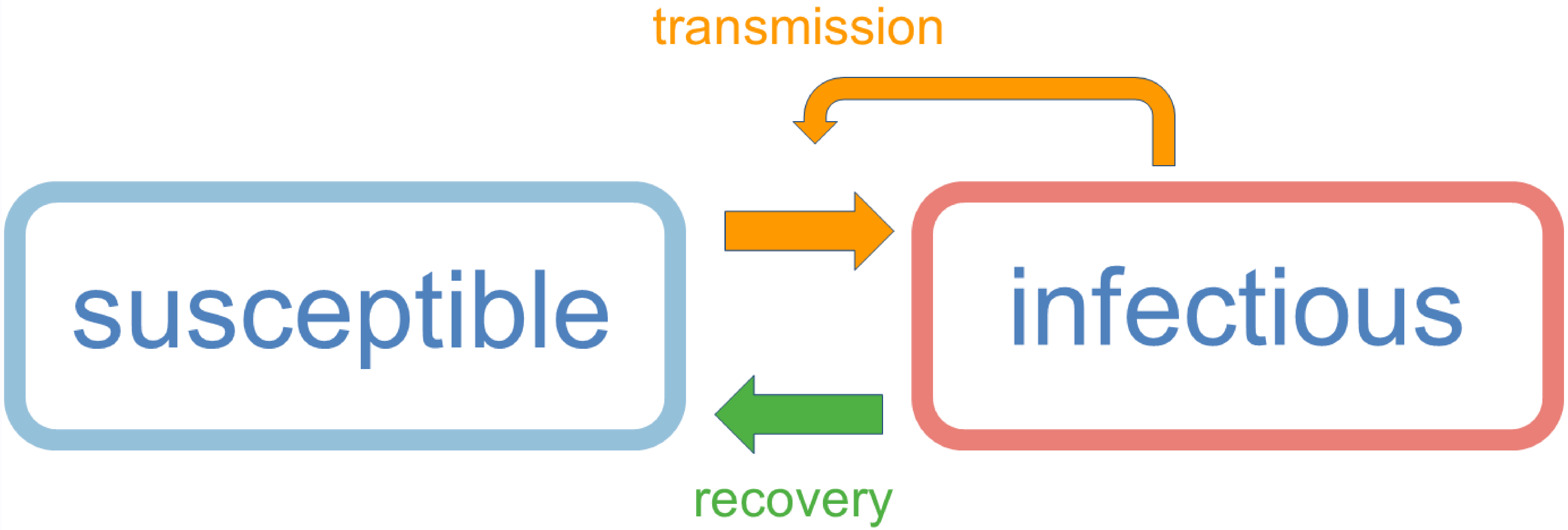
*Geoffrey Githinji*

# Learning outcomes

By the end of this lesson, students should be able to:

- write a compartmental model in R
- Numerically simulate a model

# Recap: Flow diagrams for disease transmission




*SIS model*

# Setting up the model variable and parameters

**timeHorizon** <- 365  = length of the simulation

**Delta** <-1  =  incremental time step (day)

**timesteps** <- Delta* timeHoziron = model simulation time

**N** = 500 # human population

**# parameters**
beta <- 0.3 =  # transmission rate
gamma <- 0.1 = # recovery rate

# Writing up the equation of the model

**Susceptible population**

Excel formula

$$\boldsymbol{S[t+1] = S[t] + Delta * (-beta * I[t]/N * S[t] + gamma * I[t])}$$

ODE R Equation

$$\boldsymbol{dS <- -beta * S * I / N + gamma * I}$$

**Infected population**

Excel formula

$$\boldsymbol{I[t+1] = I[t] + Delta * (beta * I[t]/N * S[t] - gamma * I[t])}$$

ODE R Equation

$$\boldsymbol{dI <- beta * S * I / N - gamma * I}$$

# Running the model with a loop - In Excel

In Class Demo

# From Excel loop to deSolve in R

Ordinary Differential Equation **solver in R using the desolve package**

- Eliminates the need to manually choose Delta
- Automatic Step Size Control: Unlike before for the fixed Delta, ODE solvers automatically adjust step sizes for optimal accuracy

In Class Demo