

How Diseases Spread

Part 1: Pathogens and Infectious Disease

Pathogens and infection are defined and explored. An overview of the human immune system is presented.

- COVID-19: A Global Pandemic
- Pathogens Cause Disease
- What Is an Infection?
- The Human Immune System
- Check Your Understanding
- Summary of Part 1

Part 2: Modeling Epidemics

Disease patterns are explored using a basic model of susceptible, infected, and recovered individuals (SIR). Diseases can recur in cycles.

- Modeling Disease Spread
- Susceptible, Infected, Recovered:
The SIR Model
- Three Determinants of Disease Spread
- A Closer Look at the SIR Model
- Basic Reproductive Number
- Epidemic Threshold
- Births, Deaths, and Disease Cycles
- Check Your Understanding
- Summary of Part 2

Part 3: Controlling Disease Spread

Vaccination can impart herd immunity, which depends on the disease's basic reproduction number. Infectious diseases can be controlled with community mitigation strategies.

- Smallpox: A Disease Eradicated
- Vaccinating Against Smallpox
- Herd Immunity
- Measles: A Different Story
- Critical Immunization Threshold
- How Does Behavior Affect Disease Spread?
- Flattening the Curve
- Public Health Options Are Limited by Disease Attributes
- Check Your Understanding
- Summary of Part 3

Part 4: Vector-Borne Diseases

The dynamics and challenges of diseases spread indirectly via vector are explored, using malaria as an example.

- Many Pathogens Have Multiple Hosts
- Disease Transmission Modes
- An SIR Model for Vector-Borne Disease
- Modeling Endemic Malaria
- Tools for Fighting Malaria
- Check Your Understanding
- Summary of Part 4

Part 5: The Evolving Nature of Disease

The basics of pathogen evolution are investigated, and the virulence trade-off hypothesis discussed.

- Shining Evolution's Light on Disease
- How Does Influenza Evolve?
- Spillovers, Reassortment, and Pandemics
- What Makes a Disease Successful?
- Evolution Favors the Optimal Level of Virulence
- Check Your Understanding
- Summary of Part 5

Part 6: Quiz Questions

Quiz Questions

- Quiz Questions
- Feedback Survey

Part 7: Disease Spread Playgrounds

Open-ended exploration of SIR model and Simplicoid simulation.

- Two Disease "Plague-grounds"