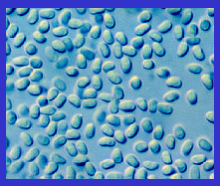
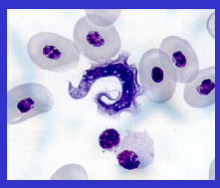
Welcome to:

Ecology of Disease

Prof Peter O'Donoghue

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Description

- Study of ecological interactions between disease-causing organisms, their hosts & the external environment; to explain disease occurrence, distribution & transmission.
- Impact of vector biology, drug resistance, water/food treatment, reservoir hosts on disease incidence.
- Mathematical prediction models

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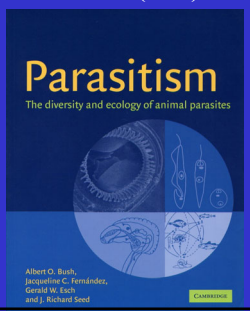
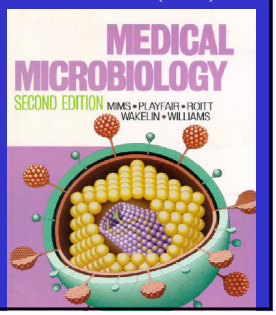
References

No single recommended text

Bush *et al.* (2001)



Mims *et al.* (2004)



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PATHOGENS

Micro-organisms
- Viruses
- Bacteria
- Protozoa
- Helminths
- Arthropods

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HOSTS

Animals
- Mammals
- Reptiles
- Birds
- Fish
- Arthropods

Plants
- Cultivars

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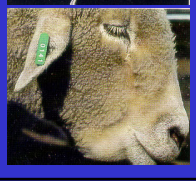
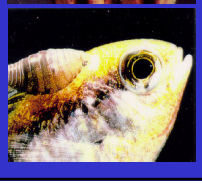
DISEASES

Infectious
- Enteric
- Blood
- Tissues
- Organs
- External

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ENVIRONMENTS

- Aquatic
- Terrestrial
  - moisture
  - temperature
  - oxygen

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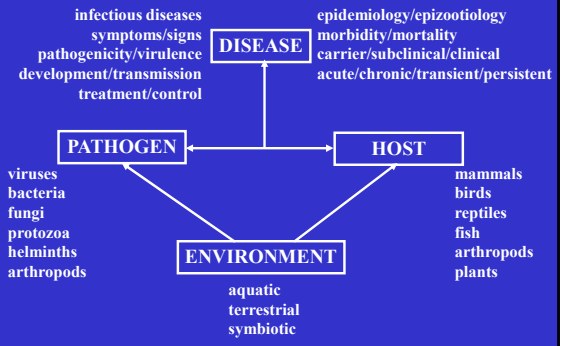
ECOLOGY OF DISEASE



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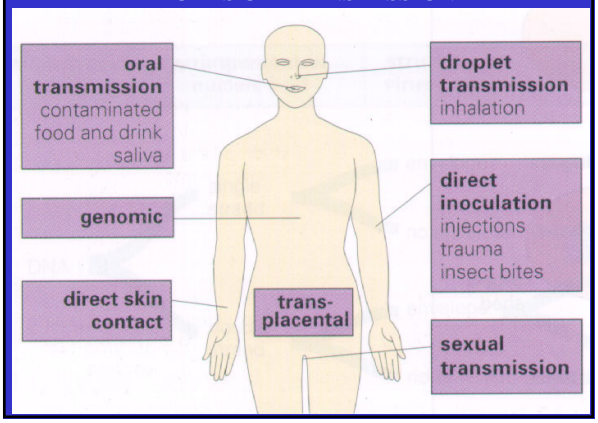
MODES OF TRANSMISSION



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Learning Objectives

You will learn to:

- differentiate endemic and emergent diseases;
- recognize patterns of infection;
- understand transmission factors;
- investigate water-borne outbreaks of disease;
- assess hazards inherent to food production;
- understand the role of paratenic and reservoir hosts;
- analyse the impact of climate on organism survival;
- apply mathematical principles to disease prediction (modelling greenhouse effects, deforestation, urbanization).

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Epidemiology?

Like ecologists, epidemiologists seek to understand:

- species richness (biodiversity)
- species abundance (populations/communities)
- species distribution (temporal, spatial)

Study human pathogens = epidemiology
Study animal pathogens = epizootiology

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Epidemiological studies

Four main types:	Maths
• Case series (descriptive) – index, incidental, miscellaneous	not quantitative
• Case control studies (retrospective) – cases + controls interviewed	statistics Odds Ratio
• Cohort studies (prospective) – cohort followed forward in time	statistics Relative Risk
• Outbreak studies (predictive) – rate of change in population	calculus Differential Equations

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OR and RR

	CASES	CONTROLS
EXPOSED	A	B
UNEXPOSED	C	D

Odds Ratio (OR) = $\frac{AD}{BC}$

Relative Risk (RR) = $\frac{A / (A+B)}{C / (C+D)}$

>> 1 causative?
~ 1 no association
<< 1 protective?

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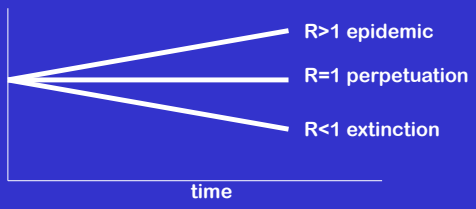
OUTBREAKS

Pathogens must reproduce themselves to survive (reproduction rate = R)



Basic (case) reproduction rate (Ro)
= average number of secondary infections resulting from primary case in susceptible population

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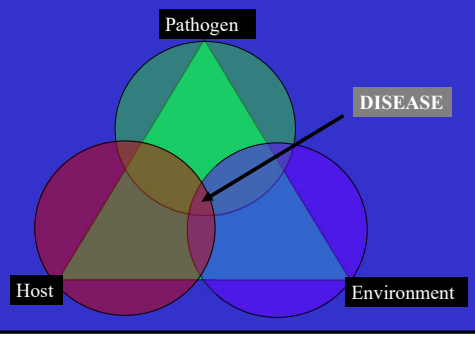
The Disease Triangle



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