Communicable Diseases: A Primer

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POLL QUESTION:

What communicable diseases will you be primarily working on?

- ❑ Enteric/foodborne pathogens
- ❑ STIs
- ❑ Vaccine preventable diseases
- ❑ Respiratory diseases
- ❑ HAIs
- ❑ Will vary, depending on where I am needed
- ❑ Not sure yet
- ❑ ALL THE THINGS!

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Objectives

- Name 6 types of communicable pathogens
- Describe difference between “droplet” transmission and “airborne” transmission
- Name 3 diseases typically transmitted via the airborne route
- Understand difference between incubation period and communicable period

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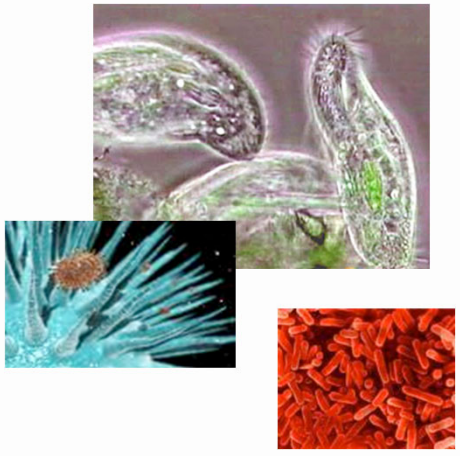
Communicable Pathogens

- Bacteria
- Viruses
- Prions
- Protozoa
- Fungi
- Helminths



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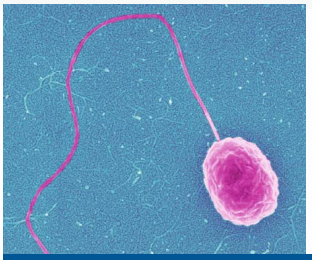

Vibrio parahaemolyticus

Legionella pneumophila

Bacteria

E. coli O157:H7

Yersinia pestis

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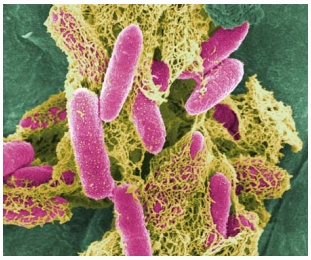
Characteristics of Bacteria

- Extremely abundant
- Microscopic
- No nucleus
- Serve many positive roles
- Some pathogenic



E. coli O157:H7

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Examples of Bacteria of Public Health Significance:

- *E. coli* O157:H7 (STEC)
- *Vibrio parahaemolyticus*
- *Legionella pneumophila*
- *Yersinia* spp.

E. coli

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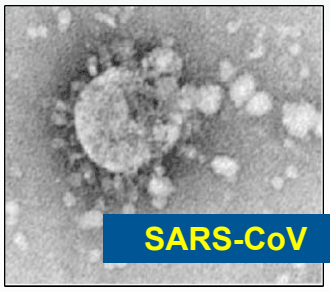
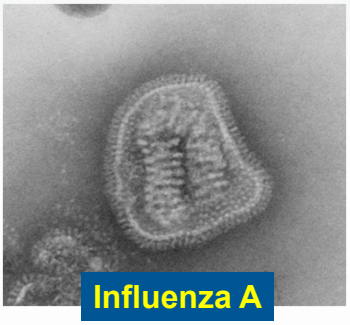
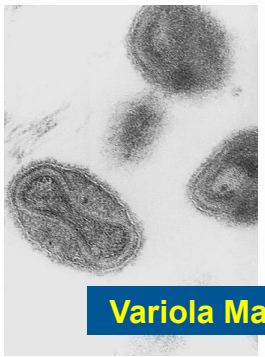




Viruses



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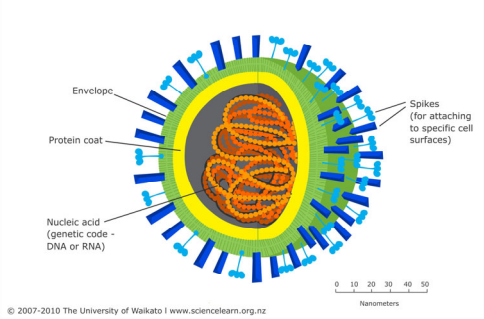
Characteristics of Viruses

- Ultra microscopic
- Nucleic acid core (DNA or RNA) with outer protein coating (capsid)
- Replicate by hijacking host cell



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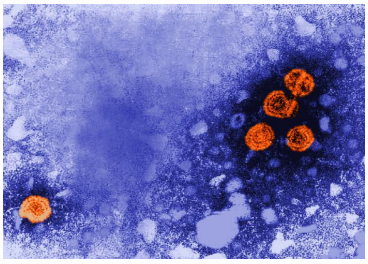
Examples of Viruses of Public Health Significance:

- Hepatitis A, B, C
- Measles (Rubeola)
- Variola major (smallpox)
- Influenza A



Hep B virions

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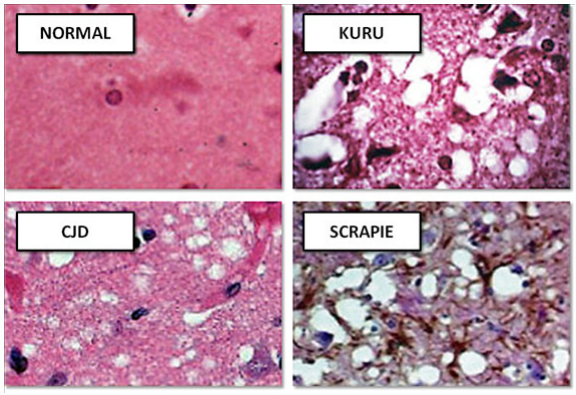
Prions



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Characteristics of Prions

- Variation of normal protein found in most mammalian cells
- Abnormally folded protein induces abnormal folding in adjacent proteins
- Resistant to heat, radiation, chemical treatment
- Non-living

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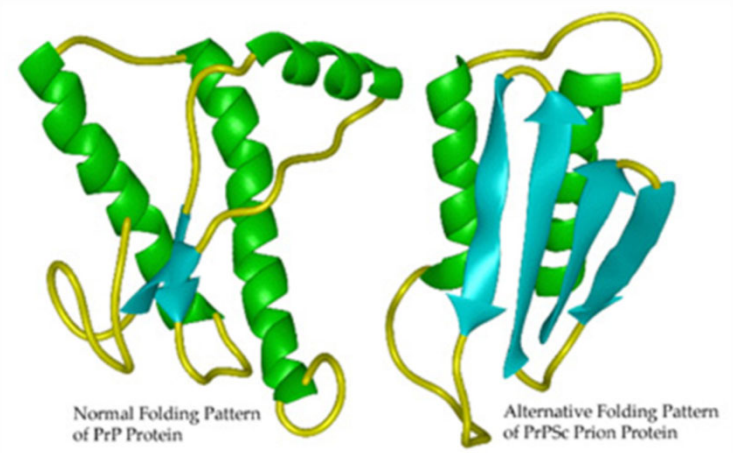

Illustration of normal PrP protein & abnormal PrPSc

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Examples of Transmissible Spongiform Encephalopathies (TSEs, AKA prion diseases):

- Creutzfeldt–Jakob disease (CJD)
- Bovine Spongiform Encephalopathy (mad cow disease)
- Scrapie

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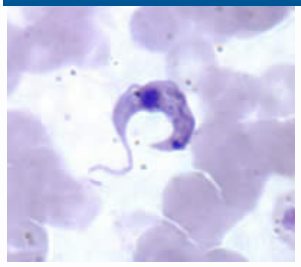
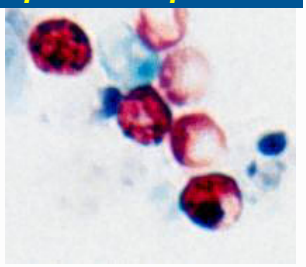
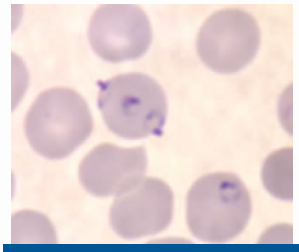
Trypanosoma cruzi



Cryptosporidium parvum



Protozoa



Plasmodium falciparum

Giardia intestinalis

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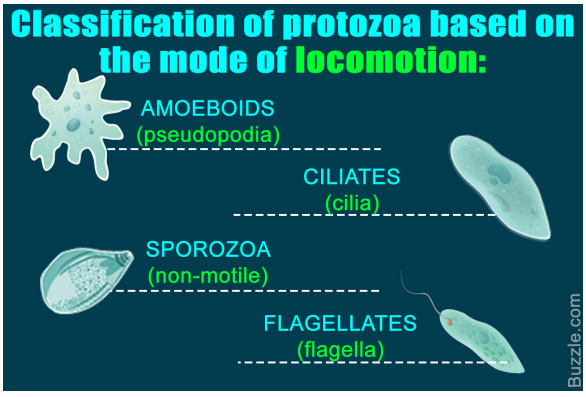
Characteristics of Protozoa

- Greek: "first animals"
- Single cell
- Microscopic, but large
- Classified by type of motion



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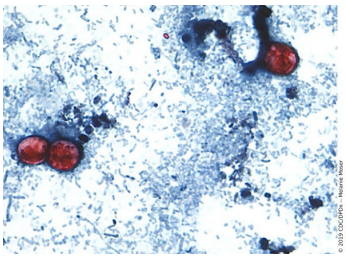
Examples of Protozoa of Public Health Significance:

- *Cyclospora cayetanensis*
- *Cryptosporidium spp.*
- *Giardia intestinalis*
- *Plasmodium falciparum*



Cyclospora

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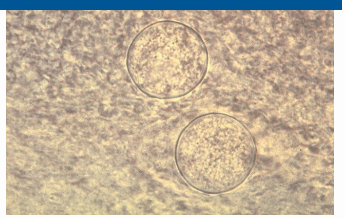
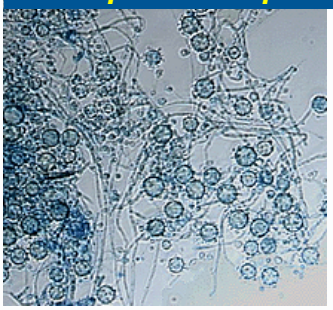
Coccidioides immitis



Histoplasma capsulatum



Fungi

Cryptococcus neoformans

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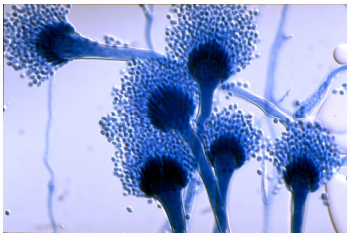
Characteristics of Fungi

- More related to animals than plants
- Thick cell wall
- Unicellular fungi are typically called 'yeasts'
- Most fungi are multicellular
  - Form threadlike network of hyphae



Aspergilla

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Examples of Fungi of Public Health Significance:

C. auris

- *Candidozyma auris (FKA Candida auris)*
- *Cryptococcus neoformans* and *C. gattii*
- *Coccidioides immitis*

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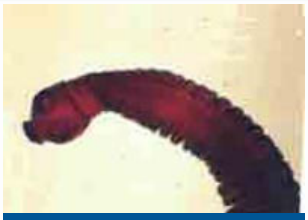

Taenia solium (pork tapeworm)

Toxocara canis

Helminths

Ancylostoma

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Characteristics of Helminths

- Multicellular parasites
- Vary greatly in size

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Examples of Helminths of Public Health Significance:

- *Ancylostoma* spp. (hookworm)
- *Toxocara* spp. (cat or dog roundworm)
- *Taenia solium* (pork tapeworm)

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That's enough worms for today…

DISEASE TRANSMISSION

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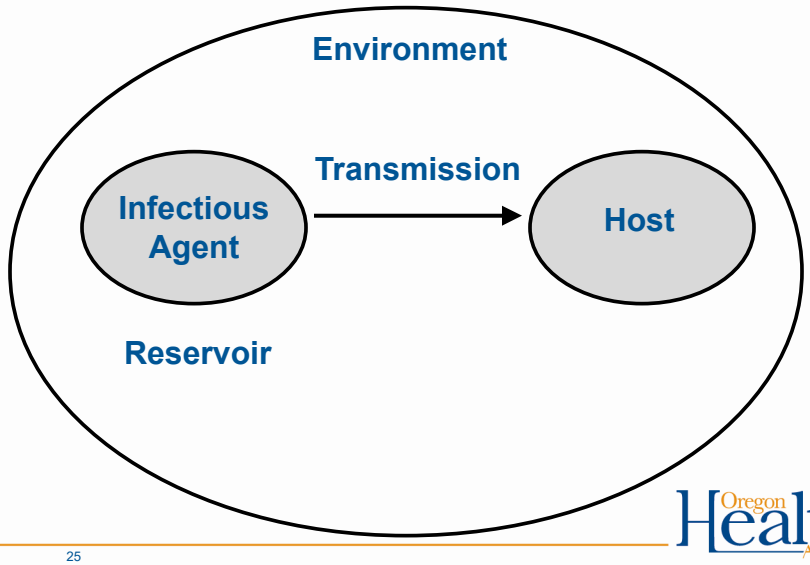
Transmission of an Infectious Agent



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Reservoir of Infection

- Anywhere an infectious agent normally lives and multiplies
  - People
  - Animals
  - Environment

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Examples of Reservoirs of Infection:

- **Measles:**
- ***Vibrio parahaemolyticus:***
- **Plague:**
- ***Legionella*:**

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Examples of Reservoirs of Infection

- **Measles:** humans
- ***Vibrio parahaemolyticus*:** water
- **Plague:** wild rodents
- ***Legionella*:** water

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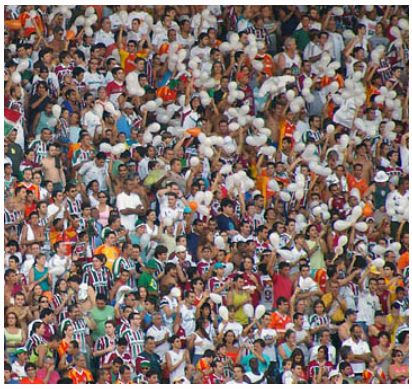
Examples of Host Characteristics:

- Age
- Sex
- Immune status
- Chronic conditions
- Many others



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Examples of Environmental Factors:

- Temperature
- Humidity
- Sanitation
- Crowding
- Air pollution

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Direct Disease Transmission

- **Person-to-Person Contact**
  - Passed directly from hands or mucous membranes
  - Examples: shigellosis, hepatitis A, STDs
- **Bloodborne**
  - Transfusion, transplant, needles
  - Examples: hepatitis B, hepatitis C, HIV
- **Vertical**
  - Mother to baby *in utero* or at birth
  - Examples: rubella, hepatitis B, HIV

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Direct Disease Transmission

- **Droplet**
  - Water-heavy particles in nose and throat
  - Fall to ground within ~6 feet
  - Most “respiratory” diseases: influenza, rubella, pertussis, meningococcal disease, *Haemophilus influenzae* infection, others

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Indirect Disease Transmission

- **Airborne**
  - Particles <5 μm in size evaporate, leaving "droplet nuclei"
  - Act as gas, remain suspended in air for long periods
  - Examples: measles, chickenpox, tuberculosis

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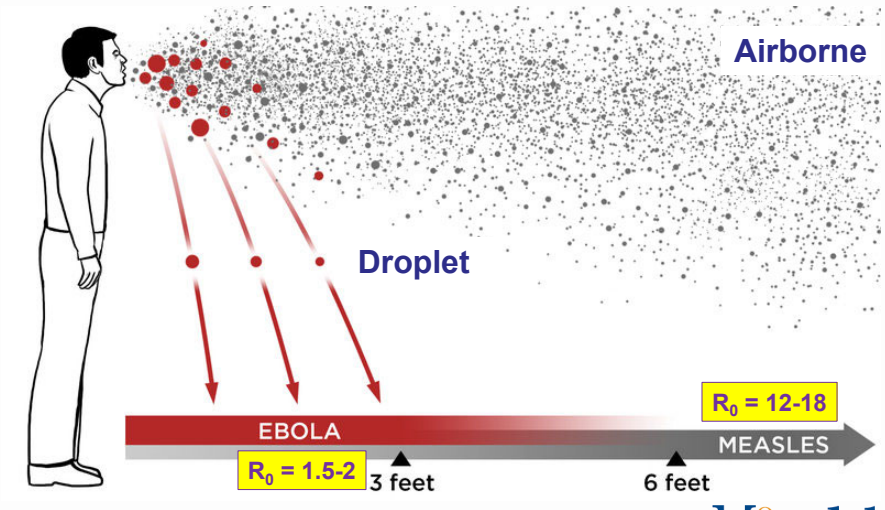
A little context…



https://www.npr.org/sections/goatsandsoda/2014/12/01/364749313/ebola-in-the-air-what-science-says-about-how-the-virus-spreads

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Indirect Disease Transmission

- **Vehicle-borne**
  - Usually foodborne or waterborne
- **Vector-borne**
  - Arthropod vector, via bite, feces, or direct contact
  - Examples: West Nile virus (mosquitoes), plague (flea), shigellosis (flies)
- **Fomites (singular, *fomes*)**
  - Contact with contaminated inanimate object
  - Examples: doorknobs, soiled sheets

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POLL QUESTION:

Which poses the greatest risk for disease transmission?

- ❑ Droplet transmission
- ❑ Airborne transmission
- ❑ Both pose equal risk

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Incubation Period

The time interval between exposure to an infectious agent and the appearance of clinical signs

Exposure → Minutes...Months…Years → Disease Onset

Incubation Period

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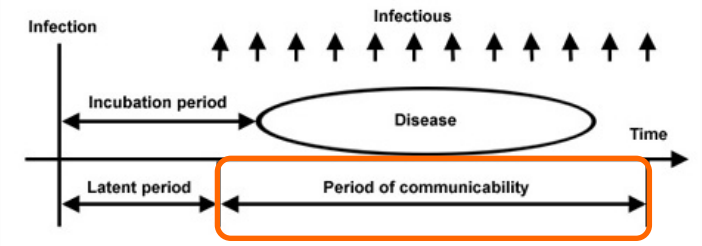
Communicable Period

The time during which an infectious agent can be transferred directly or indirectly from an infected individual to another individual



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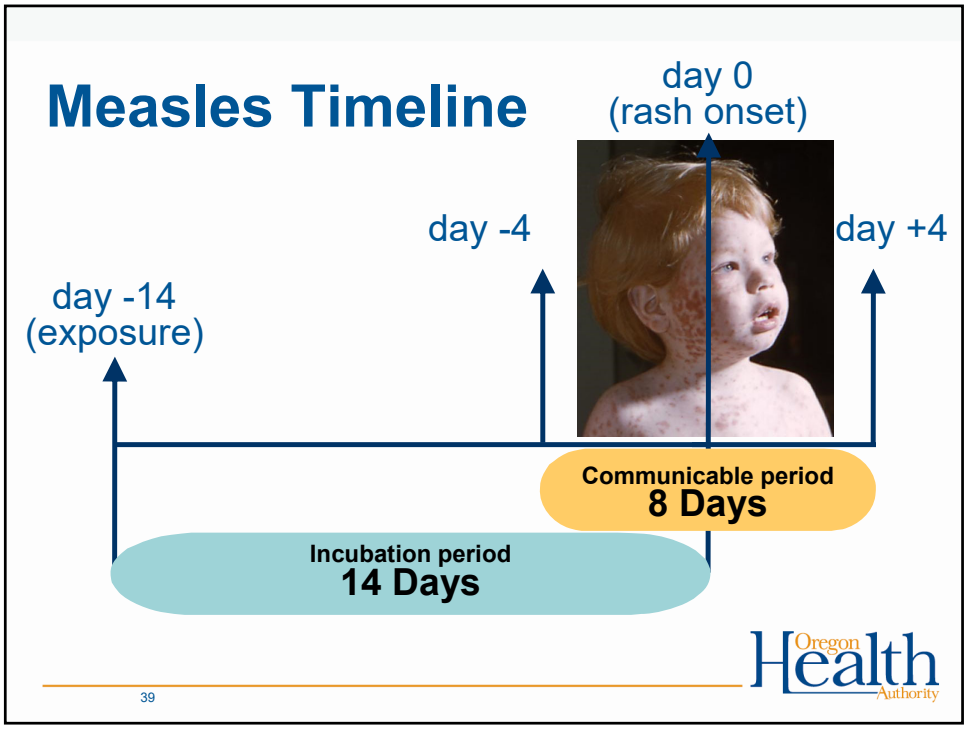
Measles Timeline
day 0
(rash onset)
day -4
day +4
day -14
(exposure)
Communicable period
8 Days
Incubation period
14 Days
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Review
40
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Review Question 1:

Explain the difference between **droplet** transmission and **airborne** transmission

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Droplet vs. Airborne Transmission

- Droplet Transmission
  - Water-heavy particles from nose & throat
  - Fall to ground within 6 feet
- Airborne Transmission
  - Particles <5 μm in size evaporate, leaving "droplet nuclei"
  - Droplet nuclei act as gas; remain suspended in air for long periods

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Review Question 2:

- Name 3 diseases typically transmitted via the airborne route
  - ❑ ?
  - ❑ ?
  - ❑ ?

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Airborne Transmission

- Measles
- Chickenpox
- Tuberculosis

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Review Question 3:

Describe the difference between **incubation period** and **communicable period**

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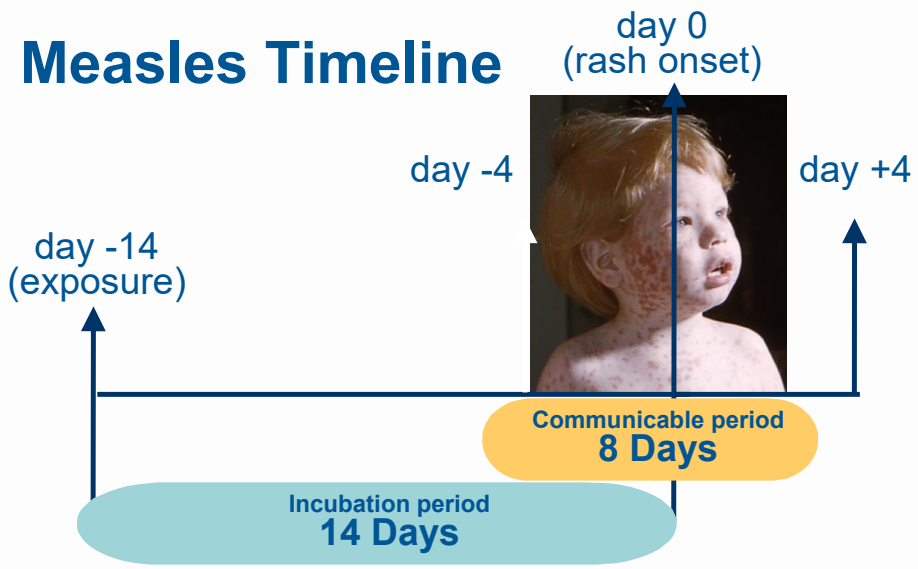
Measles Timeline



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Questions?