What is a pathogen?

- A microorganism capable of causing a disease in any susceptible host
- Host: living organism that serves to nourish and house other organisms

An opportunistic pathogen rarely causes disease in someone with a healthy immune system.

- Diseases caused by opportunistic pathogens are typically found among groups of the elderly, cancer patients receiving chemotherapy, or people who have AIDS, or someone on antibiotics, (all of whom may have a compromised immune system)

Infection results when: a pathogen invades and begins to grow within the host

Disease results only when: tissue function is impaired (i.e. burns, skin lesions) as a result of invasion or growth of the pathogen
In medieval times most people believed that supernatural forces created diseases to punish mankind.

As early as 1530 it was suggested that syphilis and other diseases could be contagious (transmitted by direct contact with infected persons, materials or infected air)

In the late 1600s Anton van Leeuwenhoek developed the microscope and so discovered the presence of microscopic organisms
Robert Koch studied the disease anthrax and devised a set of steps known as “Koch’s Postulates” to prove that a particular bacteria caused a specific disease.

It is now known that in order to cause disease, pathogens must: enter, adhere, invade, colonize and inflict damage by producing enzymes or toxins.
Pathogens enter your body through several orifices

1. Mouth
2. Nose
3. Eyes
4. Gastrointestinal tract
5. Urinary tract
6. Genitals
7. Open skin wounds
Chain of Infection

- Infectious agent
- Reservoir host
- Portal of exit
- Mode of transmission
- Portal of entry
- Susceptible host
- HANDWASHING is the best way to **BREAK** the “chain of infection”
Occurrence of infectious diseases

- Epidemiology- the study of the occurrence of disease in a population
- Epidemic- classification of a disease that appears as new cases in a *given human population*, ...
- Pandemic- a *global* disease outbreak
Herds (or community immunity) describes a type of immunity that occurs when the vaccination of a portion of the population (or herd) provides protection against a certain disease.

If the proportion of the population that is immune exceeds the herd immunity level for the disease, then the disease can no longer persist in the population ...
Your Wonderful Body

Your body has some defense mechanisms in place to protect you from illness. Can you name some?........

- Skin
- Tears
- Earwax
- Nasal hairs
- Eyebrows
- Normal flora like E coli
- Low pH
- High salinity (sweaty)
YOUR SKIN IS YOUR BEST LINE OF DEFENSE IN THE FIGHT AGAINST DISEASE

Take extra good care of it!
Immunity

- Active immunity: when the person is exposed to a live pathogen, develops the disease, and becomes immune as a result of the primary immune response.

- Artificially acquired active immunity can be induced by a vaccine, a substance that contains the antigen. A vaccine stimulates a primary response against the antigen without causing symptoms of the disease.

- Passive immunity: is a short-term immunization by the injection of antibodies that are not produced by the recipient's cells.

- Naturally acquired passive immunity occurs during pregnancy, in which certain antibodies are passed from the maternal into the fetal bloodstream.
Microbes that cause infection

**Virus**

- Apart from the host cell, **has no metabolism and cannot reproduce**
- Is resistant to antibiotics
  
  (In 1932, the invention of the electron microscope allowed viruses to be visualized)
- Cause disease by **disrupting the normal cell function**
- Classified by: shape, size, and type of genome
DNA viruses

How it works: A viral particle attaches itself to a specific host cell then inserts itself into the host cell where it uses the host cell’s enzymes to replicate its own DNA, then it is released into the body

DNA viruses cause:
- Polio
- Rabies
- Chicken pox
- Common cold
- Small pox
- Herpes zoster (cold sore)
- Genital Herpes
RNA viruses

How it works:

Genetic material used directly as messenger RNA to produce genetic material for new viral particles or copies the RNA genome into DNA and integrates itself into the host.

Frequently exhibits a LONG latent period where the virus has time to copy and distribute itself into the host.

RNA viruses cause:

- Retrovirus  HIV (human immunodeficiency virus) that causes AIDS
- Rhino virus- common cold
- Influenza
- Measles
- Mumps
- Rotavirus-gastroenteritis
BACTERIA

- Divided into two broad classes based on cell wall structure which influences their **gram stain** reaction

**Gram negative bacteria** appear **“pink”** after staining
- Salmonella typhi or typhoid fever

- Yersinia pestis: the plague. **Found in rodents**

**Gram positive bacteria** appear **“purple”** after staining
- Staphylococcus aureus: skin, respiratory and wound infections
- **Clostridium tetani** (tetanus): produces a toxin that can be fatal-lock jaw. Its **reservoir is the soil**
FUNGI

- Has a rigid cellulose based wall
- **Reproduces by forming spores**
- Most are multi-cellular except for the yeasts which are unicellular
- They are **decomposers of the environment**
- **Difficult to kill due to hard shell**—autoclave best way to break down the hard shell and destroy

**Diseases caused by fungi**

- Ringworm
- Histoplasmosis-lung infection caused by bat or bird droppings
- Yeasts of the *candida* genus (vaginal yeast infections) and **thrush** (a throat infection) these commonly affect those who are immuno-compromised or undergoing antibiotic therapy (antibiotics reduce the normal presence of bacteria in the throat and vagina, allowing yeast to grow) Think opportunistic!
PROTOZOA

- Unicellular
- Have no cell walls and rapid and flexible movement
- **Heterotrophic**—An organism that cannot synthesize its own food and is dependent on complex organic substances for nutrition
- Eukaryotes—animals, plants, fungi, are organisms whose cells are organized into complex structures by internal membranes and a cytoskeleton (Includes the amoeba and paramecium)
- Acquired through ingestion of contaminated food or water or the bite of an infected mosquito
- **More likely to be found in tropical climates**

**Diseases caused by protozoa:**

- Diarrhea in the U.S. caused by 2 common protozoan parasites: *Giardia lamblia* and *Cryptosporidium parvum*
- Malaria is caused by *Plasmodium*
HELMINTHS

Simple invertebrate animals (no spine)

Infectious parasite

They are considered **animals**

Because they are animals, their physiology is similar to ours. This makes it difficult to kill them as the drugs used to kill them may be toxic to human cells.

**Symptoms: abdominal pain and diarrhea**

**Diseases Caused by Helminths**

- **Schistosoma-swimmer’s itch**

- **Trichinella spiralis** (The adult worms are found attached to or buried in the mucosa of the duodenum) Females produce living young (approximately 1,500 per female over a period of 4 to 16 weeks) and then die. Juveniles enter the lymphatics and mesenteric veins and are found throughout the arterial circulation between the 7th and 25th day after infection. They travel in the hepatoporal system through the liver, then to the heart, lungs, and the arterial system, which distributes them throughout the body. They are transported to striated muscles, penetrate individual fibers, and cysts are formed around the juveniles. Within cysts, juveniles remain viable for many years, up to 25 years in man and 11 years in pigs.

- **Causes: abdominal pain and diarrhea**

- If left untreated, leads to **congestive heart failure** and **respiratory paralysis**
Prions

Linked to degenerative disorders of the CNS (central nervous system) to infectious particles that consist of only protein.

**Diseases caused by Prions**
Cruetzfeldt-Jacob (in humans), scrapie in sheep and bovine spongiform encephalopathy “mad cow disease” in cattle.

All prion diseases frequently result in brain tissue that is riddled with holes.

Some prion diseases are inherited while others are due to eating infected tissue or having tissue transplants.
THE END