

Source: [KBiologyMasterIndex](#)

# 1 | Overview of Human Diseases

A lecture by Paul.

#flo #disorganized

**Disease** is an abnormal condition that causes impairment in/loss of function of an organism (a.k.a. decreased fitness) that is not due to immediate external injury.

- What causes human disease?
  - Infectious agents
  - Deficiency disorders
  - Heritable factors
  - Physiological disorders (immunodeficiency, autoimmune disorders, allergies, etc.)

## 1.1 | Congenital vs. Acquired disease

Congenital diseases => diseases present at birth due to DNA abnormalities / pregnancy pathological issues

Acquired diseases => diseases that begin during lifetime, including...

- Microorganism invasion => “infectious diseases”
- Autoimmune reaction
- Nutrient deficiency
- Mechanical wear
- Ingestion of noxious chemicals

### Infectious diseases actually smaller on the causes of death in the US

- Heart disease => wear + deficiency
- Cancer => heritable + DNA
- Unintentional injuries => not a disease
- Chronic respiratory disease => wear
- Stroke => not a disease
- Alzheimer disease => wear
- Diabetes => autoimmune, nutrient, wear
- Influenza <= **here, finally, an infectious disease.**

## 1.2 | Disease causing agents

- **Protozoan** => single-celled eukaryotes
- **Fungal** => single/multi-celled eukaryotes
- **Bacteria** => single-celled prokaryotes
- **Viral** => acellular parasitic infectious agent
- **Helminths** => multicellular worms
- **Prions** => acellular misfolded proteins
- **Viroids** => infectious nucleic acids w/o protein coat to make virus

### 1.3 | Pathogenicity + Virulence

**Pathogenicity** => relative capacity to cause disease

- Non-pathogenic agents => no disease
- Primary pathogens => yes disease
- Opportunistic pathogens => yes disease only when it can, for instance, in immunocompromised individuals

**Virulence** => numerical measures for pathogenicity

- Measured experimentally with LD50 + ED50
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### 1.4 | Overview of various diseases

This video

#### 1.4.1 | Protozoan

- **Protozoan factors** => direction pathogenesis leading to tissue damage
- **Host-mediated factors** => immune evasion + escape mechanisms + immunosuppression

Adaptable!!

#### 1.4.2 | Fungal

- **Fungal factors** => many shapes and very adaptable, could produce specialized enzymes to take root in body
- **Host-mediated factors** => cause immunocompromise, acquired through inhalation, etc.

#### 1.4.3 | Bacteria

- **Bacterial-induced toxicity** => produces toxins + has hard capsule cell
- **Host-mediated factors** => may develop host resistance, could compete for resources, and could be grown intracellularly



Figure 1: Screen Shot 2020-10-12 at 3.08.53 PM.png

## 1.5 | Bacteria causing diseases

### Biofilm formation

- Communities of bacteria could work together by adhering and exchanging information
- Bacteria could perform quorum sensing => exchange of information with each other + recognize various members of their group

### 1.5.1 | Fighting bacterial infections

**Antibiotics** => drugs with selective toxicity for specific bacterial types

Act by...

- Disrupting membrane + cell wall integrity
- Selectively target + impair bacterial ribosomes
- Block bacterial DNA replication/transcription
- Inhibit bacterial metabolism

## 1.6 | Viruses causing diseases

- Viruses => acellular macromolecular assemblies
  - Contain protein coat called capsid
  - DNA or RNA, but not both
  - Are obligate parasites that could only replicate within host
- Assembled and mature viral particles => virions, which contain...
  - Capsid
  - Genetic material
  - Occasionally outside lipid layer
- Viruses exist on the nanometre scale, but they are different in shape and size

- Structure of viruses
  - **All contain**
    - Capsid => structural protein coat
    - Genome => RNA/DNA; but not both
  - **Some contain**
    - Membraneous-enclosed capsid => envelope
    - Externally-facing host-cell fusion proteins => spikes
    - Viral genome replication enzymes => polymerases
    - Other proteins for fun => enzymes, motor proteins, transcription factors, host-cell interacting proteins, etc.
- Two types of virus
  - Prokaryotic-infecting viruses
    - Variety of shapes
    - Complex and prolate shapes
    - Has, sometimes complex shapes! a la this image
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