Infectious Diseases
Cause HALF worldwide deaths - 25 million/year
5-10% developed nations; 60-70% developing
Caused by biological agents, usually…
Microbial Pathogens: viruses, bacteria, parasites
Many transmitted by vectors - e.g. insects

Contrast non-infectious: genetic, environmental

Top 15 Infectious Diseases
12-15: Tropical Parasites - 0.13 million/year
11: Hepatitis B - 0.10 million/year*
10: Syphilis - 0.16 million/year
9: Meningitis - 0.17 million/year*
8: Tetanus - 0.21 million/year*
7: Pertussis - 0.30 million/year*
6: Measles - 0.60 million/year*
5: Malaria - 1.3 million/year
4: Tuberculosis/TB - 1.6 million/year
3: GI/Diarrheal Diseases - 1.8 million/year
2: HIV/AIDS - 2.8 million/year
1: Pneumonia/Influenza - 3.9 million/year

*Effective vaccines given in developed nations;
Some Emerging - New (e.g. SARS Pneumonia);
Some Re-Emerging - Old Problems (e.g. TB)

Class Organized by Group - Big to Small
Unit 1: Parasites/Protozoa - Eukaryotic Cells
Unit 2: Bacteria - Prokaryotic Cells
Unit 3: Viruses - not cells, not living
Unit 4: GI, Respiratory - many agents above

For each, there are 1-2 homework/discussion activities and 1 exam with case-study essays.

Unit One Start - Introduction to Biology

Concept One: What Is Living?
Organization - made of cells, DNA information
Growth, development, reproduction
Evolution and adaptation - respond, regulate
Metabolizes and processes energy

Cells either eukaryotic (unit one) or prokaryotic (unit two) - compare/contrast for final!

Eukaryotic Cells
Cell membrane - fats/lipids, some proteins
Cytoplasm - between nucleus, cell membrane
Nucleus - command center, DNA information

Phylum Nematoda - a.k.a. Roundworms
From the Greek: nematos = thread; ode = like
20,000 known species, 15,000 parasitic
Diverse aquatic and soil habitats

Important biological control agents. Others will be described during GI diseases lectures.

Anatomy and Physiology
Pseudocoelom/simple body cavity, no segments
GI: simple mouth to gut tube
MS: outer cuticle, hydrostatic, simple muscles
BG: no vessels, simple diffusion
SL: cilia hairs, simple nerves, no central control

Domain - New Term Since 1980’s
3 Domains - uses DNA sequence data, genetics
Generally reflects cell structure, appearance
Eukaryotes - animals, plants, fungi, protozoa
Bacteria - prokaryote, moderate, 3% pathogens
Archaea - prokaryote, extreme, no pathogens

Traditional Kingdoms = animals, plants, fungi, protozoa, and monera (bacteria & archaea).

Introduction to Animal Kingdom
Home of the parasites - Unit One

Some Key, Relevant Features
Multicellular eukaryotes - so which domain?
Many show distinct tissue and organ structure
Metabolism: use chemicals for energy
Most reproduce sexually, some asexual/clone
About 16 phyla - only 1 includes vertebrates

Major Organelles - mitochondria, chloroplast…
Motility Proteins - flagella, cytoplasmic filaments
Hard Outer Wall (some) - e.g. cellulose, chitin

Think about - strong evidence that organelles = engulfed/enslaved prokaryotes…

Concept Two: Hierarchy of Biology
Molecules: carbohydrate, fat, protein, DNA/RNA
Cells: prokaryotes vs. eukaryotes
Multicellular Organization: tissues, organs
Ecology: interactions - organisms, environment

Concept Three: Classification
Domain, Kingdom - know for all agents
Phylum, Class, Order, Family - know if given
Genus species - know for all agents if given
Strains - sometimes used, differ by 1-5 genes

Challenge problem for next time: classify yourself using appropriate terms above.
GI (gastrointestinal), MS (muscle/skeletal), BG (blood/gas), SL (sensory, locomotion).

**Reproduction and Development**
Reproduction: sexual, dimorphic
In host: female worms birth 1000+ embryo/day
Embryos to larvae that move through blood
Taken up by insect vectors, new larvae forms
Mature in new host - location varies with disease

**Lymphatic Filariasis**
First agent mosquito-linked - Bancroft, 1876
Mostly in tropical Anopheles mosquitoes
Human Tissues - lymphatic system, blockage

Lymphatic Filariasis - Disease
High volume of molting larvae, dying adults
Acute lymph destruction/blockage, inflammation
Elephantiasis - constant untreated, skin necrosis
*Wuchereria bancrofti* - extremities, genitals
*Brugia malayi* - extremities, not genitals

**Lymphatic Filariasis - Epidemiology**
120 million affected worldwide - total, current
75% Asia/Pacific; 25% Latin America, Africa
Last endemic US cases - S. Carolina, 1920s
15,000 US Servicemen contracted, WWII
7% Haitian refugees to US infected

**Onchocerciasis/Loa Loa Eyeworms**
Major causes of blindness, carried by…
Tropical fast-water *Simulium* flies (*Onchocerca*)
Tropical *Chrysops* deer flies (Loa Loa)
Tissues affected - subcutaneous skin, 5% eye
Highly prolific - 15 years, 2000+ embryos/day

**Eyeworm - Disease**
From bite, larvae migrate through blood/lymph
5% cases result in blindness - agent in eyeball
Where worms mature, defenses make capsules
Tissue thickens/keratitis, loses pigment, itches…

Even without blindness, can infect lymph nodes
and cause elephantiasis-like symptoms.

**Eyeworm - Epidemiology**
20 million affected worldwide - total, current
Majority - Africa: Nigeria, Sudan, Congo region
Others - Middle East, Latin America, Asia
Slave trade introduced to Americas 1500-1800
Napoleon - Sudanese troops in Mexico, 1862
*Onchocerca* (worldwide), *L. loa* (West Africa)

85% West African eye lesions, with 50% adult males blind; Typically, tourists don’t contract.

**Anti-Nematode Treatment - Avermectin Drugs**
Similar in structure to GABA - neurotransmitter
Vertebrates - GABA only brain because of BBB
Nematodes lack CNS but use GABA as a…
Neuromuscular transmitter throughout body
If we take orally, BBB keeps out of brain - so?

Older drugs (DEC/diethylcarbamazine) similar effect but less specific (i.e. more side effects).