SPORE-FORMING GRAM POSITIVE BACILLI (RODS)					
BACILLUS- aerobic					
BACTERIA	**DISEASE**	**SYMPTOMS**	**TRANSMISSION**	**DIAGNOSIS / TREATMENT**	**CHARACTERISTICS**
Bacillus Anthracis	Anthrax	Not discussed Bad poison; easy to track, hard to assemble	Contact with ANIMALS (cows & sheep) or SOIL Bioterrorism & warfare	RAPID treatment is essential Antibiotics Vaccine against PA protein available	Only bacteria with antiphagocytic **PROTEIN capsule** (most are sugar) **Aerobic** growth conditions V. **stable spores** (heat, drying, UV, disinfectant resistant) Toxins produced after spore germination (only under good growth conditions) **Exotoxin**: 3 different proteins (nontoxic separately) ● Edema Factor (EF) ● Protective Antigen (PA) ● Lethal Factor (LF) **Plasmids**: BOTH required for virulence ● pXO1: encodes exotoxins; virulence factors transcribed optimally @ 37°C, inc. CO^2 and serum proteins ○ ANIMAL HIDE ● pXO2: encodes plasmid genes
Bacillus Cereus	Food Poisoning	**Heat Labile**: nausea, abdominal pain, diarrhea (12-24 hours) **Heat Stable**: SEVERE nausea & vomiting, short incubation	Undercooked food infected with spores	Preformed toxins mean antibiotics are USELESS!	Motile, non-encapsulated Resistant to penicillin 2 **enterotoxins**: ● Heat-labile toxin ● Heat-stable toxin

SPORE-FORMING GRAM POSITIVE BACILLI (RODS)					
CLOSTRIDIUM- anaerobic; POWERFUL EXOTOXINS (require rapid diagnosis)					
BACTERIA	**DISEASE**	**SYMPTOMS**	**TRANSMISSION**	**DIAGNOSIS / TREATMENT**	**CHARACTERISTICS**
Clostridium Botulinum	Botulism (rapidly fatal food poisoning from lethal neurotoxin)	Bilateral, symmetrical, top-down, flaccid paralysis!!!!! Afebrile (no fever) Double vision, trouble swallowing RESP. PARALYSIS (usually fatal symptom) **Infant botulism**: honey contaminated by spores; bacteria colonize intestine; 2-3 days of constipation; floppy baby syndrome, death	Smoked fish Improperly canned vegetables Fermented meat (common aboriginal prep method) Honey in children under 3 = infant botulism if spores present Proper cooking destroys spores	Antitoxin RESP. ASSISTANCE until respiratory muscles regain function	**Exotoxin**: neurotoxin that blocks ACh release in autonomic nervous system Botox (type A) diluted ● Useful for excessive sweating, muscle disorders
Clostridium Tetani	Tetanus	Sustained skeletal muscle contraction Severe muscle spasms (lockjaw) Death by heart failure	Spores enter through a break in the skin Spores found in soil & animal feces Rusty nail MUST HAVE SPORES Wound provides anaerobic environment	**Booster** (inactivated toxoid) given every 10 years to maintain immune response ● Most other vaccines don't require this!!!	**Exotoxin**: tetanospasmin
Clostridium Perfringens	Gas Gangrene	**Wound infection / cellulitis**: necrotic skin exposed to bacteria; damage to local tissues; skin feels moist/spongy with "crackly" pockets	Soldiers wounded in battle; open wounds in damp conditions Wound provides anaerobic environment	Clostridial myonecrosis class treated with OXYGEN, ANTIBIOTICS (penicillin), and REMOVAL OF DAMAGED TISSUE	Spores release **gas** under skin; causes crackling skin symptom

		Clostridial myonecrosis: bacteria inoculated from trauma into muscles; exotoxin secretion destroys adjacent muscles; BLACK FLUID secreted from skin; FATAL if untreated			
Clostridium Difficile	Antibiotic associated pseudomembranous colitis	Infects the **colon**, where it releases exotoxins **Toxin A**: diarrhea **Toxin B**: cytotoxic to colon cells Severe diarrhea Abdominal cramping Fever	Arises from overuse of broad spectrum antibiotics, which destroy normal intestinal flora Enters orally Very common in hospitals- **NOSOCOMIAL**	Considered immediately in patients who have diarrhea & are on antibiotics Discontinue antibiotic treatment Vancomycin or metronidazole (given orally; not absorbed into bloodstream) Live probiotics to restore flora	2 **Toxins**: • Toxin A • Toxin B

NON SPORE-FORMING GRAM POSITIVE BACILLI (RODS)					
BACTERIA	**DISEASE**	**SYMPTOMS**	**TRANSMISSION**	**DIAGNOSIS / TREATMENT**	**CHARACTERISTICS**
Listeria Monocytogenes	Listeriosis	**30% mortality** General malaise Diarrhea Meningitis Septicemia Still birth / miscarriage Gastroenteritis (gastric inflammation)	Soft cheeses, unpasteurized milk, cold cuts, pâté	Ampicillin or trimethoprim-sulfamethoxazole	One of few bacteria that can **cross all 3 protective barriers** • Blood-brain • Gastrointestinal • Feto-placental Immunocompromised are at high risk **Psychrotroph/phile**; grows at room temp **Facultative intracellular aerobe**
Corynebacterium Diphtheriae	Diphtheria	Colonization of **pharynx** and release of exotoxins into **bloodstream**	Inhalation (colonizes pharynx)	**3 step treatment** 1. Antitoxin 2. Antibiotic	Can be **lysogenized** by a **bacteriophage** (helps it)

		Damage to **heart** & **neural cells** Bull neck, respiratory symptoms, greyish membrane covering throat		3. DPT vaccine	

NON SPORE-FORMING GRAM NEGATIVE BACILLI (RODS)- THE ENTERICS >> diarrhea! :^)
Part of normal intestinal flora; can also cause disease
4 major groups (based on **biochemical** & **antigenic** properties)

- Enterobacteriaceae (Salmonella, Shigella, E. coli)
- Vibrionaceae (Vibrio, Campylobacter)
- Pseudomonadaceae (Pseudomonas)
- Bacteroidaceae

Classification Types

Biochemical:

- **Ability to ferment lactose** (selective/differential media)
  - EMB media: lactose fermenters are dark purple/black; inhibits gram + bacteria
  - MacConkey media: lactose fermenters are pink/purple; inhibits gram + bacteria
- **H_2S (hydrogen sulfide) production**
- **Hydrolysis of urea**
- **Liquify gelatin**
- **Decarboxylation of amino acids**

Surface antigens: H.O.K.

- **H-antigen**
  - Flagellar subunit; only in motile bacteria
- **Variable O-antigen**
  - Outermost layer of LPS; changes between enterics
- **K- antigen**
  - Capsule that covers the O-antigen

Types of Enteric Diseases

- **Diarrhea with or without systemic invasion** (ex: vibrio cholera)
  - No cell invasion; bacteria bind intestinal cells but do not enter
  - EXOTOXIN causes diarrhea & ENTEROTOXIN causes fluid/electrolyte loss
    - **Watery diarrhea**
  - No fever!
- **Diarrhea with invasion of intestinal cells** (ex: shigella)
  - Invasion of cell allowed by virulence factors
  - Toxins destroy cells
    - **Bloody stool**
  - Systemic immune response
    - Fever!
- **Diarrhea with invasion of lymph nodes and bloodstream** (ex: salmonella enterica)
  - Abdominal pain
    - **Diarrhea containing WBCs & RBCs**
  - Fever, headache, increased WBC count
- **Various other infections**
  - UTIs, pneumonia, bacteremia, sepsis

NON SPORE-FORMING GRAM NEGATIVE BACILLI (RODS)- THE ENTERICS					
ENTEROBACTERIACEAE					
BACTERIA	**DISEASE**	**SYMPTOMS**	**TRANSMISSION**	**DIAGNOSIS / TREATMENT**	**CHARACTERISTICS**
SALMONELLAE	Unable to ferment lactose; motile; all have animal reservoirs except *S. enterica* serovar Typhi; **2 species**: *S. enterica* & *S. bongori* (salmonellae enterica more important) **5 types of infections in humans**: ● enterocolitis, enteric fever, opportunistic infections, septicemia, and osteomyelitis				
Salmonellae Enterica Serovar enteritidis **&** Serovar typhimurium	Enterocolitis (tummy problems)	6-48 hour multiplication in **small intestine** Nausea, vomiting, **profuse** diarrhea, abdominal pain Fever, chills, headache, myalgia (muscle pain) Septicemia (rare) Recovery in 2-3 days	Need fairly large dose for pathogenesis Ingestion of contaminated food Poultry, eggs, meat, and milk Person-to-person spread possible (fecal-oral) Most cases occur at home Under-reported and underdiagnosed	**Stool culture** for lab diagnosis Antibiotics **not** recommended ; grow better with some antibiotics	Severity of disease impacted by: ● health of host ● dose of ingested organisms ● virulence of infecting strain
Salmonellae Enterica Serovar typhi **&** Serovar paratyphi	Enteric Fever	Serovar typhi = **typhoid fever** Serovar paratyphi = **paratyphoid fever** (milder) Generalized infection Bacterial multiplication in lymphoid tissue Necrosis of intestinal lymphoid tissue; ulceration, hemorrhage, perforation 10% mortality if	Contaminated drinking water, shellfish, milk & milk products **Convalescent carriers**: excrete bacteria for 3 months through stool **Chronic carriers (1-2%)**: excrete bacteria for at least 6 months (sometimes forever)	**1st week**: isolation of bacteria from blood **2nd-3rd week**: isolation from stool & urine Vaccine available; only effective against small bacterial load	Relatively high infective dose Clean handling of food, proper water treatment & sanitation are essential

		left untreated			
ESCHERICHIA COLI	Most numerous aerobic bacteria of normal gut flora; pathogenic to other parts of the body >>responsible for 85% of all bacteriuria Lactose fermenting Implicated in **neonatal meningitis** and **nosocomial urinary** / **wound infections**				
Enterotoxigenic E. coli	Gastro-enteritis	Infant diarrhea (developing countries) Traveller's diarrhea	Unfamiliar strains in foreign country's water or food	Not discussed	**Enterotoxins**
Enteroinvasive E. coli	Gastro-enteritis	Symptoms similar to shigellosis	Not discussed	Not discussed	Not discussed
Enteropathogenic E. coli	Gastro-enteritis	Infant diarrhea	Not discussed	Not discussed	Older name for some serotypes causing infant diarrhea
E. coli O157:H7 **Hamburger disease**	Gastro-enteritis	Hemorrhagic colitis (bloody diarrhea)	Undercooked hamburgers Improperly washed/prepared food	Not discussed	Safe preparation and cooking of food are essential to prevent illness
SHIGELLAE	Generally non-lactose fermenting				
Shigellae Sonnei	Not discussed	Acute diarrhea with mucus, pus, and blood	Not discussed	Not discussed	Not discussed
Shigellae Dysenteriae	Dysentery	**Severe** illness; acute watery diarrhea with mucus, pus, and blood	Infection from **small** number of organisms Poor sanitation and crowding	No vaccine	Commonly seen in **children** Prevention by safe food handling, water treatment, sewage disposal
Vibrio Cholerae	Cholera (acute gastro-intestinal illness)	**Profuse** watery diarrhea, cramps, vomiting (rice water) **Severe** dehydration and death if untreated	Water-borne Endemic in Southeast Asia and parts of Africa Unclean drinking water	Not discussed	Cells secrete **chlorides** which **decrease Na^+ absorption**; water accumulates in gut and leads to watery diarrhea
Campylobacter jejuni &	Human enteritis	Fever, abdominal pain, **bloody diarrhea** Traveller's	Normal flora in **birds** & **domestic animals**	Not discussed	Some strains **invasive**, others **toxigenic**

Campylobacter coli		diarrhea			
PSEUDOMONAS	Opportunistic pathogen; all strains are resistant to many antibiotics				
Pseudomonas aeruginosa	Resp. pathogen	Respiratory illness in cystic fibrosis patients Infections in lesions of burn patients	Found in many moist habitats and water Source of infection may be humidifiers	Treatment is difficult; antibiotic resistant	Opportunistic pathogen
Pseudomonas cepacia	Resp. pathogen	Respiratory illness in cystic fibrosis patients	Found in many moist habitats and water Common contaminant of saline solutions water Source of infection may be humidifiers	Treatment is difficult; antibiotic resistant	Opportunistic pathogen Able to multiply in **low nutrient** environment
Haemophilus influenzae	Invasive infections in young children	Meningitis, pneumonia, joint infections Increased bronchial inflammation in patients with chronic bronchitis	Normal nasopharyngeal flora in many adults & children	Development of vaccine; now used routinely Decreased number of cases in Canada	
Cronobacter (formerly enterobacter)	Nosocomial infections Enterobacter sakazakii = infant illness from powdered formula	Wound infections, pneumonia, bacteremia	Hospitals Powdered infant formula Most common in low birth weight babies	Not discussed	Not discussed
Helicobacter pylori	Stomach ulcers	Stomach ulcers (prev. thought to be caused by stress & diet)	Not discussed	**Triple therapy treatment**: antibiotics & H^+ inhibitors	**Microaerophilic** **Spiral bacilli** Produces **urease** which creates a **high pH** environment; protects from low pH
Bordetella	Whooping	Violent cough	Inhalation	Vaccination	**4 virulence factors**:

pertussis	cough			w/ **heat-killed** organism	1. Pertussis toxin (A-B) 2. Extracytoplasmic adenylate cyclase (weakens host defense) 3. Filamentous hemagglutinin (bronchial attachment and exotoxin release) 4. Tracheal cytotoxin (destroys ciliated cells poor clearance of mucous and bacteria)
Legionella pneumophila	Legionnaires disease	Severe pneumonia Other lung problems	**No** person-person transmission (very weird for an airborne pathogen!!!) **Aerosol transmission** Grows in **water**; found in shower heads, water tanks, air heating/cooling tanks		**Opportunistic pathogen**

WAXY COAT ACID-FAST BACILLI - MYCOBACTERIA

Causative agent of **tuberculosis** & **leprosy**

Waxy coat
- **NO gram stain**, resistant to **disinfectants**

Acid-fast
- Resistant to **decolorization**

Use **Ziehl-Neelsen** staining technique!

BACTERIA	DISEASE	SYMPTOMS	TRANSMISSION	DIAGNOSIS / TREATMENT	CHARACTERISTICS
Mycobacterium Tuberculosis	TB!	**Primary TB**: cell mediated immunity; **chronic slow progressing** > Inhalation > Multiplication in alveoli > Cell-mediated immune response > Lung infection > Active CMI > Infection stopped > Reactivation years later Leading cause of death worldwide from a single infection **Post-primary TB**: late reactivation of lesions in lungs, kidneys, bones, etc 5% of cases; higher in AIDS patients Chronic infection	Inhalation of **aerosol droplets**	**4-6 weeks** to see colonies on plate Lowenstein-Jensen medium Use **microscopy** of **sputum smears** as **first** line of diagnosis **Mantoux test** Tuberculin solution injected **intradermally**; wait 48-72 hrs; check for **induration** (hard bump) **Positive**: **>10mm** Not necessarily active infection **Doubtful**: **5-9 mm** Likely reaction to other mycobacteria **Negative**: **<4mm** **ZN STAINING**	**Obligate aerobe** Facultative **intracellular** parasite Infection develops in **stages** (see primary symptoms) **Cell-mediated immunity**
Mycobacterium Leprae	Leprosy	**Tuberculoid Leprosy**: visible nerve enlargement; few **erythematous plaques** (can be mistaken for wine stains, etc); many	**Tuberculoid**: low infectivity **Lepromatous**: high infectivity; rarely found in developed countries	**ZN STAINING**	Not discussed

		lymphocytes & **granulomas** **Lepromatous Leprosy**: no visible nerve enlargement; many **erythematous nodules** (boil-like, red patches, etc), **many bacilli** in infected tissue, nodules of NZ+ pus, disfiguring			
ATYPICAL MYCOBAC-TERIA	Most typically seen in **immunocompromised** patients				
M. kansassi, M. avium, M. intracellulare	Seen in chronic lung disease	Not discussed	Not discussed	Give **doubtful** mantoux test Resistant to anti-TB drugs	**Indistinguishable** from **TB** In **chronic lung disease** patients
M. marinum	n/a	**Skin infections**	Not discussed	Not discussed	Not discussed
M. fortuitum	n/a	**Soft tissue abscesses**	Not discussed	Not discussed	Not discussed

SPIROCHETES (LONG SQUIGGLY THINGS)					
BACTERIA	**DISEASE**	**SYMPTOMS**	**TRANSMISSION**	**DIAGNOSIS / TREATMENT**	**CHARACTERISTICS**
Treponema Pallidum	Syphilis	**Primary Syphilis**: appearance of **chancre** 3-4 weeks after infection **Secondary Syphilis**: 5 weeks after chancre appears; generalized or local **rash**, mucosal **lesions** w/ many **treponemes** (bacteria)	**Contact** with infected **chancre** Latent syphilis non-transmittable after **4 years**; but **congenital** infection may occur	**Serological** testing; **Non-treponemal** tests (VDRL, RPR, Wassermann): > non-specific > can't confirm diagnosis alone > positive in early stages **Treponemal** tests > specific (use treponemal extracts)	Gram **negative** **Helical** bacteria Unculturable **in vivo** **Dark field microscopy!!!** Almost **invisible** under gram stain, geimsa stain, and ZN stain

		Spontaneous remission may occur after stage 1 or 2 **Latent Syphilis**: no symptoms; congenital infection may occur **Late Syphilis**: obliterative endarteritis (artery inflammation); can involve skin, mucosae, NS, cardiovascular sys, and tissues		> FTA-ABS (fluorescent treponemal antibody absorption) > MHA-TP (microhemagglutination of T. pallidum) > used to confirm positive VDRL	
Borrelia Burgdorferi	Lyme Disease	**Bullseye rash** (not necessarily where bite occurred) Affects skin, joints, NS, and heart	Bites by **infected** deer ticks Common in US, rare in Canada	**Serology** for diagnosis (**ELISA**) No positive result in first **2-3 weeks** of infection Treat w/ antibiotics for **early** disease **Prolonged treatment** for **neurological** & **musculoskeletal** manifestations Vaccine available (**ospA antigen**)	Organism very **difficult to see** under microscope Difficult to culture

CHLAMYDIAE (COCCI);
Obligate intracellular energy parasites; can **not** make their own **ATP/other energy** intermediates
Can **not** be grown on artificial media
Life cycle (2 forms):

- **Elementary body**: (300-400 nm)
  - Infectious form
  - No growth or replication
  - Sexually transmitted
- **Reticulate body**: (800-1000 nm)
  - Turns into reticulate body once it's been transmitted
  - Actual infection

BACTERIA	DISEASE	SYMPTOMS	TRANSMISSION	DIAGNOSIS / TREATMENT	CHARACTERISTICS
Chlamydia Trachomatis	**STI Chlamydia** **Trachoma** (chronic ocular infection; leading cause of **blindness** in middle east, southeast asia, and north africa) **Conjunctivitis** in **newborns** (perinatal transmission) **Lymphogranuloma venereum** (STD from some serotypes; endemic in (sub)tropical countries)	Many patients **asymptomatic** & **untreated** **Male**: urethritis **Untreated**: prostatitis, epididymitis **Female**: cervicitis **Untreated**: PID, tubal infertility, ectopic pregnancy, chronic pelvic pain	Sexually transmitted **Perinatal** (right before birth) transmission to newborns	**Limited** diagnostic tools	**Most common** STI in Canada and USA **2 biovars**: • Trachoma • Lymphogranuloma venereum **Trachoma**: 15 serovars **LGV**: 4 serovars
Chlamydia Pneumoniae	Not discussed	Mild pneumonia, respiratory tract infections Usually **subclinical**	Not discussed	Not discussed	Not v important! No real distinguishing features!
Chlamydia Psittaci	Not discussed	Pneumonia or endocarditis	**Bird pathogen**	Not discussed	Remember **birds**!

MYCOPLASMA
Smallest **free-living** bacterium (100-300 nm)
Saprophytes (eat organic material); part of normal flora of **oropharynx** & **genital tract** of humans & animals
No true cell wall
Some species are pathogenic

BACTERIA	DISEASE	SYMPTOMS	TRANSMISSION	DIAGNOSIS / TREATMENT	CHARACTERISTICS
Mycoplasma Pneumoniae	Primary cause of **atypical pneumonia**	**Primary** cause of atypical (free-walking) pneumonia *important **Rarely** complications lead to meningoencephalitis or myocarditis	Person-person aerosol droplet inhalation	Usually **clinical** No lab confirmation Treat with erythromycin or tetracycline	More common in **younger** individuals (15-35 years)
Genital Mycoplasma (mycoplasma hominis, ureaplasma urealyticum)	Not discussed	Urethritis, PID, and postpartum fever Controversial role in premature birth and infertility	Colonization rates increase with **number of sexual partners**	Not discussed	Part of normal **genital** flora

MYCOTIC (FUNGAL) INFECTIONS
Depth of infection (skin to bloodstream)
- Superficial
- Cutaneous
- Subcutaneous (lymphatics)
- Systemic (bloodstream)

FUNGUS	DISEASE	SYMPTOMS	TRANSMISSION	DIAGNOSIS / TREATMENT	CHARACTERISTICS
Cryptococcus	Not discussed	Not discussed	Not discussed	Not discussed	**Systemic** fungal infection Associated with **AIDS** patients
Aspergillus Flavus	Not discussed	Not discussed	**Grain products**	Not discussed	Mycotoxin produced: **aflatoxin**

PARASITES
Intimate & obligatory symbiotic relationship; parasite dependent on host
Short term (mosquito) or long term (tapeworm)
Very common (50% of animals are parasites)
Host: organism that is home/food source
Intermediate host: secondary home
Vector: how parasite gets from host to host (tick is vector for lyme disease)

Success of parasite determined by:

- Prevalence in host
- Number of host species available
- Geographic range
- Number of offspring
- Available routes of transmission

PARASITE	DISEASE	SYMPTOMS	TRANSMISSION	DIAGNOSIS / TREATMENT	CHARACTERISTICS
Giardia Lamblia	Acute giardiasis	Most people are asymptomatic carriers Diarrhea, weight loss, abdominal discomfort, nausea, vomiting Retardation of growth and development in young children (failure to thrive); CNS issues	**Fecal-oral** (resistant cysts) Most common in young children (more poop exposure) Can be **food** or **water** borne Travelers & immuno-compromised at higher risk Much more common in **developing world** Improvement of awareness and hygiene/ sanitation necessary	**String test** (plastic nub on string swallowed, pulled back up throat, and tested for antigens) **Microscopy: Stool exam** (cysts concentrated by flotation and identified using bright-field microscopy) **Immunological testing: ELISA** Detection of **giardia-specific** antigens in stool Treated w/ **nitroimidazole** derivatives	Most frequently identified **intestinal** parasite in the world **Protozoan** (single cell organism) **Life cycle** ● Trophozoites in bowel become **cysts** that are shed in stool **Chlorine-resistant** (water filtration)
Trichomonas Vaginalis	Vaginitis trichomoniasis	40-50% **asymptomatic** carriage **Vaginitis**; itching, foul-smelling, sometimes frothy discharge May lead to	**Mucous membrane** contact (no cyst shedding)	**Microscopy** (wet mounds) to identify trichomonads in **vaginal** or **urethral** discharge Testing and treatment of	Possibly most common STI **worldwide** No resistant cyst stage Vary greatly in size

		cervical cancer and **HIV** infection Infection during pregnancy = **premature delivery / low birth weigh**t **Males** usually **asymptomatic;** occasionally urethritis/ prostatitis		**partners** is necessary to avoid **reinfection** **Metronidazole** & **tinidazole**	
Entamoeba Histolytica	Not discussed	Typical infection of large intestine may be **asymptomatic** or result in **diarrhea/ constipation** **Amoebic dysentery** in some patients: **bloody/mucoid** diarrhea!!!! May spread through **blood** to produce **liver**, **lung**, **or brain abscesses**	**Fecal-oral** Person-person, contaminated water, raw produce, food handlers, flies Largely related to **poor sanitation** & **hygiene** Improvement of awareness and hygiene/ sanitation necessary Common in **tropical developing** countries	**Microscopic** identification of **trophozoites** or **cysts** in **feces** or **lesions** **Luminal amebicides** (act on organisms in intestinal lumen) For **symptomatic** intestinal disease or **extraintestinal** infections (liver, lung, brain): **metronidazole** or **tinidazole**	Not discussed
Toxoplasma Gondii	Toxoplasmosis	**Immunocompetent host**: 90% asymptomatic, lymphadenopathy, headaches, muscle aches, fever, malaise **Immunocompromised host**: encephalitis (brain inflammation), myocarditis, pneumonia (AIDS-defining; indicates that patient has AIDS)	**Ingestion** of sporulated **oocysts** (contaminated soil/sand, fruits/vegetables, waterborne outbreaks, cat poop) **Ingestion** of **tissue cysts** (raw or poorly cooked meat) **Congenital infection** of	**Serological assays** Immunocompetent patients don't usually require treatment Immunocompromised: require **prompt** treatment with **pyrimethamine** & **sulfadiazine** Congenital: mother/fetus can	Very high **seroprevalence** in humans worldwide Large number of mammal/bird **intermediate** hosts Cats only **definitive** hosts; shed **oocysts** in feces

		Congenital infection: hepatosplenomegaly (liver/spleen swelling), mental retardation, retinochoroiditis (retinal inflammation), hydrocephalus (fluid in brain)	fetus; most severe if acquired in first trimester	**both** be treated	
Plasmodium	Malaria	**Spiking** fever & chills **Flu-like** symptoms (myalgias, headaches, abdominal pain, malaise) **Severe** symptoms (p. falciparum): seizures, coma, renal failure, respiratory failure	**Anopheline mosquitoes** (vectors) **Blood transfusion** / **shared needles** **Congenital** infection “Airport malaria”	**Drug resistance** is a serious problem **Chloroquine** & **mefloquine** Protect against mosquito bites (long sleeves, bug spray, bed nets) **Mosquito eradication**	Largely a **man-made** disease (forest clearing, irrigation canals) Drug-resistant in **Thailand**
Crypto-Sporidium Parvum	Crypto-sporidiosis	**Watery diarrhea** (most important symptom) Dehydration, weight loss, abdominal pain, fever, nausea, vomiting Chronic, debilitating, potentially **life-threatening** in immuno-compromised *remember!!!	**WATER** (most important mode of transmission-contaminated drinking water) > outbreaks associated w/ **water parks** & **pools** **ZOONOTIC** (petting zoos> **calves**) **Person-person** (ingestion of oocysts due to poor hygiene) **Autoinfection** (thin-walled oocysts released into lumen, causing infection) > **responsible for fatal disease in immuno-**	**No drug treatment available!** **Microscopy** (intermittent oocyst shedding = multiple stool examinations) Wet-mounds or permanent stains (acid-fast) **Immuno-fluorescence microscopy**	Reported in humans **worldwide** **Life cycle**: complex; includes both **sexual** & **asexual** phases (oocysts) **Obligate intracellular protozoan** Infects **intestinal epithelial** cells (typically **small intestine**) **Acid-fast** **Water treatment** is important **Public health** education Drink **bottled water** Oocysts die >60°C

			compromised		and <-20°C
Cyclospora Cayetanensis		**Profuse** & **prolonged** diarrhea Abdominal pain, nausea, vomiting, fatigue, loss of appetite	Person-person is **unlikely** Zoonotic transmission is **unlikely** **99% of cases are FOODBORNE** **Direct contamination**: infected food handlers (poor hygiene) **Indirect contamination**: contaminated irrigation water, mixing pesticides, etc	Treated with **bactrim** **Microscopic** examination of **wet mound** stool for oocytes (bright field, differential interference contrast, auto-fluorescence) **Staining methods** (acid fast)	**Coccidian protozoan** **Low** infectious dose **1 week** incubation period **Endemic** in Nepal, Haiti, Peru, and Guatemala
Enterobius Vermicularis **(PINWORM)**	Pinworm	**Mild** infection of **cecum** / **colon** May cause **pruritus ani** (itching) leading to disturbed sleep & irritability	**Eggs ingested** (fecal-oral) Discourage itching, nail biting Change bedding/ underwear often	**Anal itching** used as diagnostic characteristic **Scotch tape test**: sticky surface used to collect egg sample from perianal area; microscopic adult female worms may be present Treat with **pyrantel pamoate**	More of a **nuisance** than a health problem Up to **50%** of children in north america get pinworm
Trichinella (spiralis & nativa)	Roundworm	**Larvae in small intestine**: diarrhea, abdominal pain, vomiting **Larvae in muscle tissues**: facial edema, conjunctivitis,	**Larvae ingested** in raw or undercooked meat **Rats** spread trichinella	**Intestinal phase**: thiabendazole **Tissue phase**: mebendazole & albendazole **Steroids**: reduce inflammation	**Small roundworm**; found worldwide in meat-eating animals **Larvae**: encysted in striated muscle **Adult**: small intestine **2 Forms:**

		fever, myalgia **Occasional life-threatening manifestations**: myocarditis, CNS involvement, pneumonitis			**Trichinella spiralis** (domestic form): humans, swine, **rats**, horses **Trichinella nativa** (sylvatic/wild form): humans, bears, wolf, etc; **resistant to freezing**
Ascaris Lumbri-coides	Most common intestinal worm (helminth)	**Asymptomatic** or **vague abdominal discomfort** Vomiting and/or **obstruction** can occur	After shedding in **feces**, eggs mature and become infective after **several days** Ingestion of **eggs** in soil, fruits/veg, or water Associated with **poor sanitation**	**Microscopy**: stool examination for eggs **Surgery** may be required to clear worm Mebendazole, albendazole, or pyrantel pamoate	Large intestinal **nematode** High prevalence **worldwide** (esp in **warm** regions) Most common human **helminth** (worm)
Anisakis Simplex	Whale worm/ herring worm	Often **invasive** (penetrates **mucosa**) Abdominal pain, nausea, vomiting	Home-prepared **sushi**, **sashimi**, and **ceviche** **Definitive hosts**: dolphins, porpoises, whales **First intermediate hosts**: marine crustaceans **Second intermediate hosts**: salmon, mackerel, cod, herring, tuna, squid	Diagnosis is difficult; **no eggs in stool** **Endoscopic** & **radiologic** examinations Often mistaken for **appendicitis**; exploratory surgery may reveal **larvae** **Drug treatment is ineffective**	Highly prevalent in **Japan** Quite rare in North America Humans are "**dead-end**" hosts **cooking/freezing** very effective in killing organism
Diphyllo-bothrium	Broad fish tapeworm	Most cases are **asymptomatic** Abdominal pain, dizziness, fatigue, vomiting, diarrhea/ constipation	**Ingestion** of raw or poorly cooked **freshwater** fish containing larvae	**Microscopy**: stool examination for **eggs** or **proglottids** (segments of worm) **Anthelmintic**	Very large **tapeworm** **Adult**: small intestine of humans & fish-eating mammals **Larvae**: freshwater fish (intermediate hosts)

		Vitamin B12 deficiency causing **pernicious anemia**		**drugs** are effective (praziquantel)	
Taenia (solius & saginata)	Beef/ pork tapeworm	Mild abdominal complaints **T. solium neurocysti-cercosis**: infection w/ larval stage of T. solium; larvae **migrate** and develop in **brain**; > intracranial hypertension, hydrocephalus, convulsive seizures	**Ingestion** of **larvae** in raw or poorly cooked meat	**Eggs** or **proglottids** in stool **Serological** techniques **Anthelmintic drugs** **Surgery**	Adult stage found **only in humans** **2 species** ● Taenia saginata (beef tapeworm); longer worm ● Taenia solium (pork tapeworm) **Both** species are **rare** in Canada **Cooking** meat kills larvae
Schistosoma **(BLOOD FLUKE)** (S. haematobium, S. japinucum, S. mansoni)	Schisto-somiasis	Usually **asymptomatic** except in heavily infected patients Rash, **itchiness** from penetrating larvae Fever, lymphadenopathy, hepatospleno-Megaly (swelling of lymph nodes, spleen, and liver)	**Free-swimming larvae** in **fresh** water **penetrate skin** and develop in blood vessels surrounding **intestine** or **bladder**	**Microscopy**: examination for eggs in **stool** or **urine** Treated with praziquantel	**NOT GI LIKE OTHERS** **Snails** are intermediate hosts **3 main species**: ● S. haematobium ● S. japanicum ● S. mansoni Avoid contact with water in **endemic** areas