Medfools Bacteriology a la chart for the USMLE I

Adapted from notes from UCLA., with additional corny mnemonics

Staphylococcus aureus	***(virulent)***	***(nonmotile, nonsporeforming, facultative anaerobe)***				***Gm+ cocci***
Diseases	Characteristics	Habitat/Transmission	Pathogenesis	Diagnosis	Treatment	Prevention
***Skin infections:** impetigo, cellulitis, erysipelas, abcess, furuncle, carbuncle ***Bacteremia/sepsis:** hematogenous spread ***Acute endocarditis:** DESTRUCTIVE (compare to S.*viridans* and S.*faecalis*) ***Pneumonia –**damaging process, cavitations, empyema, effusions ***Osteomyelitis/septic arthritis-** hematogenous and traumatic spread ***Food poisoning –** 1-8 hr onset, vomiting, <u>preformed</u> toxin ***Tox shock syndrome-** fever, vomiting, diarrhea, diffuse <u>erythematous rash</u>	Gm + cocci in grapes/clusters Catalase + coagulase +	Ubiquitous in environment; normal flora of skin/nose Spread through lesions, fomites	**Enterotoxin-** vomiting, diarrhea, heat resistant, (actually released in gut) **TSST-1** – tampon use, wounds, *superantigen* **Exfoliatin-** scalded skin <u>TISSUE SPREAD:</u> **Alpha toxin**(lechthinase)**-** skin necrosis;hemolysis **Hyaluronidase-** degrades proteoglycans **Fibrinolysin-** lysis fibrin clots <u>IMMUNE EVASION:</u> **Protein A-** binds IgG-Fc, blocks opsonization and complement fixation **Coagulase-** activates prothrombin **Hemolysin-** destroys RBCs, PMNs, M0s, platelets **Leukocidin-** destroys WBCs	Gm + cocci in grapes, **Catalase** differentiates from Strep. S.*aureus:* **Beta hemolysis, coagulase, Yellow (Au) pigment** (coagulase *causes coagulation!*) **Coagulase neg:** S. *epidermidis:* **novobiocin <u>sensitive</u>** "sensitive skin" S. *saprophyticus:* **Novobiocin resistant**	**Beta lactamase production is common!** Use methicillin, nafcillin, dicloxacillin **MRSA-** vancomycin	none

S. *epidermitis:* associated w/ IV catheters, damaged/prosthetic **heart valves: INSIDIOUS onset, Nosocomial, LESS virulent**.
Blood culture Contaminant

S. *saprophyticus:* **Community acquired UTI** in young women

Streptococcus viridans* (*GABHS*) *(nonmotile, nonsporeforming)							***Gm+ cocci***
Diseases	Characteristics	Habitat/Transmission	Pathogenesis	Diagnosis	Treatment	Prevention	
***Pharyngitis-** "strep throat", erythema, tonsillar exudate, fever ***Skin/soft tissue infections-** impetigo, cellulitis, necrotizing fascitis ***Scarlet fever**- centrifugal, red rash, erythrogenic toxin, slap cheek, strawberry tongue ***Tox shock syndrome-** clinically like *Staph* TSS ***Rheumatic fever-** fever, myocarditis, polyarthritis, chorea, subcutaneous nodules, erythema marginatum rash. **Mitral valve disease** follows **pharyngitis,** NOT skin infections. Abs vs. bacteria cross react w/ joint and heart antigens ***Acute GN**- hypertension, hematuria, edema of face/ankles. Follows both pharyngitis AND skin infections. Cross reactive antigens deposited in GBM.	Gm + cocci in **chains or pairs** **Beta-hemolytic** are classified by Lancefield groups (A,B,D) according to **C-carbohydrates**	Human throat/skin, Transmission by respiratory droplets	**Hyaluronidase**- degrades proteoglycans (TISSUE SPREAD) **Erythrogenic toxin-** scarlet fever, **lysogenized** S.*pyogenes* **Streptolysin 0-** results in **beta hemolysis**, target of ASO antibodies **M protein-** antibody target, but inhibits complement/phagocytosis **Streptokinase-** converts plasminogen to plasmin, dissolves fibrin clots **IgA protease** "**HE'S** an **MSI**"	**All** Strep are Catalase – **Beta hemolysis** and Bacitracin sensitivity point to GABHS, esp with inc. ASO titer.	**Penicillin** to prevent rheumatic fever. Penicillin DOES NOT treat post strep disease or enterococcus.		
S. *agalactiae (Group B strep)*							
Neonatal menigitis, sepsis pneumonia	**Beta-hemolytic**	Female urinary tract					
S. *faecalis* (enterococcus)							
Subacute endocarditis, UTI "Oh **crap!** I've got **Heart** problems!"	Not hemolytic	GI tract		Grows in 6.5% NaCl			
S. *bovis* (group D)							
UTI	Not hemolytic	GI tract		Hydrolyze esculin in presence of bile. NOT grow in 6.5% bile			
S. *pneumoniae* (pneumococcus)							
Lobar pneumonia, ADULT meningitis, URI (kids)	**Alpha-hemolytic**	Nasopharynx	85 different **capsular polysaccarides**	**Quellung rxn**		23 valent vaccine, for AIDS, elderly, **asplenics**	
S. *Mutans* , *mitis* (Viridans group)							
Subacute endocarditis, caries	**Alpha-hemolytic**	Oropharynx					

Neisseria	***(Chocolate agar, Oxidase +, kedney bean shape)***					***Gm- cocci***
N. *meningitidis* (meningococcus)						
Diseases	Characteristics	Habitat/Transmission	Pathogenesis	Diagnosis	Treatment	Prevention
***Meningococcemia-** fever, arthralgias, myalgias, **petechial rash,** inc. in people w/ **complement deficiencies** ***meningitis-** fever, headache, stiff neck, photophobia, **inc.PMNs** in CSF *** Waterhouse-Friedrichsen-** fever, purpura, DIC, adrenal insufficiency due to *bilateral adrenal hemorrhage,* shock, death (like a bad meningococcemia)	**Gm –** cocci **kidney beans.** **Thayer-Martin, chocolate agar**	Airborne droplets, colonized **nasopharynx,** establishes carrier states in some	**Polysaccharide capsule, endotoxin (LPS), IgA protease** Capsular polysaccharides are **antigenic** serve as markers for classification.	**Ferments maltose** Presumptive diagnosis by Gm stain of petechiae or CSF **LATEX agglutination test b/c** capsular polysaccharides	Penicillin or **Ceftriaxone (G3)**	Chemoprophylaxis with **Rifampin** (excreted into saliva) **Polysaccharide vaccine in** military recruits.
N. *gonnorhoeae (gonnococcus)*		***(most common notifiable disease in US)***				
Males- symptomatic dysuria, penile discharge b/c of **urethritis.** Leads to **epididymitis,** prostatitis, urethral strictures **Female-** asymptomatic, vaginal discharge, dyspareunia, due to **cervicitis, Infertility, PID, ectopic,** tubo-ovarian abcess, perihepatitis (**Fitz-Hugh-Curtis syndrome)**, **opthalmia neonatorum** **Both: Septic arthritis**	**NO CAPSULE** **Gm –** cocci **kidney beans.** **Thayer-Martin, chocolate agar**	Sexual transmission OFTEN coexistent WITH Chlamydia AND Syphilllis (tx w/ tetracycline or chloramphenacol)	**Pili/fimbriae (ANTIGENIC** variation) **LPS** OMPs **IgA protease** NO CAPSULE!	**Men: Gm – diplococci in PMNs** **Does NOT** ferment maltose No serologic testing, no capsule!	**Ceftriaxone (G3**) b/c penicillinase producing N.*gonnorhoeae PPNG common*	**Erythromycin** eye drops in newborns (also protects vs. Chlamydia) No Vaccine.

NOTE: bacterial meningitis: 0-6 months (Group B *Strep*, E.*coli, Listeria*); 6 months – 3 years (H.*influenzae B)*, 3-15 years (N. *meningitidis),* >15 years (S. *pneumoniae)*

Clostridium *(Anaerobic, spore-forming, with Exotoxin)*						***Gm+ Rods***
C. *tetani*						
Diseases	Characteristics	Habitat/Transmission	Pathogenesis	Diagnosis	Treatment	Prevention
Tetanus – tetany, **risus sardonicus** "joker smile", exaggerated reflexes, **respiratory failure**		**Spores, ubiquitous in soil, enter wounds and** germinate in anaerobic environment of necrotic tissue	**Tetanus toxin** travels intra axonally to CNS, **blocks release of inhibitory glycine neurotransmitter**		**Penicillin,** ventilatory support, muscle relaxants **Tetanus immune globulin,** preformed Ig	**Tetanus toxoid** (formaldehyde treated tox)
C. *botulinum*						
Botulism "flaccid paralysis", descending weakness, diplopia, flaccid paralysis, resp failure. **Wound botulism-** spores to wounds, germinate, release toxin **Infant botulism-** ingestion of spores in honey- **floppy baby**		**Spores, in soil, inadequate sterilization of canned foods.** Alkaline veggies, smoked fish.	**Botulinum toxin** ingested **preformed.** Tox spreads in blood, to nerves **blocks Ach RELEASE** **Toxin** can be used to Tx torticollis, blepharospasm		**Antitoxin,** ventilatory support **NO PENICILLIN!!** Will burst cells and release toxin	Watch swollen cans!
C. *perfingens*						
Gas gangrene (myonecrosis): war wounds, septic abortions **Food poisoning- ingestion** of cooking resistant spores in foods. **Watery diarrhea, cramps, little vomiting**	Results in **crepitus**- gas production and **Hemolysis**	**Normal flora of colon and vagina**	**Alpha tox-** lecithinase degrades cell membranes- hemolytic	Morphology, exudate smears, culture, sugar fermentation, organic acid production	Debridement, **O2 gas, Penicillin**	
C. *difficile*						
Antibiotic associated pseudomembranous colitis- esp in hospitalized pts.		Normal flora in 3% of people	**Suppression of normal flora allows overgrowth, usually by clindamycin, ampicillin, cephalosporins** Exotox A (severe diarrhea Exotox B (damage to colonic mucosa)	ID C-diff tox in stool	**Metronidazole-** poorly absorbed orally, inc. colonic dose Vancomycin	

Bacillus *(Aerobic, spore-forming, with Exotoxin)*						***Gm+ Rods***
B. *anthracis*						
Diseases	Characteristics	Habitat/Transmission	Pathogenesis	Diagnosis	Treatment	Prevention
Woolsorter's disease- pulmonary anthrax, pneumonia	Large w/ square ends, nonmotile	Common in animals. Humans infected by **spores on animal products (skins/hides)** **Transmission** through skin, GI tract, respiratory tract	**Antiphagocytic capsule** made of **d-glutamate** [only one w/ Amino acids!] (not a polysaccharide) **Tripartite anthrax toxin:** protective antigen, lethal factor, edema factor. Protective factor inhibits phagocytosis.	Morphology and blood agar growth.	Penicillin	Sterilization of animal products, and **vaccination of animals.** Vaccine (protective antigen) for humans at risk
B. *cereus*						
Vomiting with 4 hr incubation period (like S.*aureus*)- **heat stable toxin**--	Distinguished from B. *anthracis* by **motility** and **lack of capsule.**	**Spores** on grains survive cooking and germinate when food is warmed.	**Preformed heat-labile** enterotoxin (like E.*coli, Cholera tox*) - diarrhea		Treat symptoms	Avoid reheated rice

Corynebacterium *diptheriae*	***(nonmotile, nonsporeforming, Chinese)***					***Gm+ Rods***
Diseases	Characteristics	Habitat/Transmission	Pathogenesis	Diagnosis	Treatment	Prevention
Diptheria – throat inflammation, **gray fibrinous exudate** (pseudomembrane), airway obstruction, **myocarditis, recurrent laryngeal nerve palsy**	**Club shaped**, in **palisades, Chinese characters** Polyphosphate granules stain **metachromatically**	**Airborne droplets**, colonization of throat and production of Diptheria tox.	Diptheria tox: inhibits protein syn by **ADP ribosylation of eukaryotic ef-2**. Toxin produced by **lysogenized** bacteria (like erythrogenic toxin of GABHS)	**Tellurite plate, Loefller's** Toxin assessed by animal inoculation or gel diffusion precipitin test.	**Antitoxin**, **Penicillin** to reduce transmission	**Diptheria toxoid vaccine**. (disease in US is *iatrogenic* due to innoculation by inadequately killed toxin.

Listeria *monocytogenes*	***(Facultative intracelluar anerobes, Non-sporeforming, tumbling motility)***					***Gm+ Rods***
Diseases	Characteristics	Habitat/Transmission	Pathogenesis	Diagnosis	Treatment	Prevention
Neonatal meningitis and sepsis, abortion, premature delivery	Gm + rods, in clumps, Chinese characters, **NON-sporeforming, Tumbling** distinguishes it from corynebacterium	Newborns, immunocompromised are high risk groups. Transmitted to humans from animal feces, veggies, **unpasteurized milk/cheese.**	**Only Gm+ with LPS** **Infects monocytes and** induces granulomas. **Listeriolysin O** punches holes in cells	**Gm+ rods, beta hemolysis,** motility	Ampicillin	No vaccine

ENTERIC GRAM NEGATIVE RODS

Note: Not all gram negative enterics belong to ***Enterobacteriaciae family: 1) colonic location 2) facultative anaerobes 3)ferment glucose, 4)oxidase negative, and 5)reduce nitrates to nitrites***. *ALL are members here EXCEPT:* Vibrio, Campylobacter, Helicobacter, Pseudomonas, Bacteriodes. ("**V**ile **P**eople **C**an't **B**e **H**appy") As a group, ***Enterobacteriaciae*** are often **normal flora.** Pathogenisis is by endotoxin/LPS, exotoxins. **O** (**O**uter polysaccharides), **H** (flag**H**ella), **K** (**K**apsular polysaccharides) **are important antigens.** Inoculation on **MacConkey's** or **Eosin-Methylene Blue (EMB)** agar differentiates family members by **lactose fermenting** ability. Fermenters are pink-purple, non-fermenters are colorless. Also keep an eye on **motility.**

ENTERIC *(Intestinal AND non-Intestinal disease)*						***Gm- Rods***
E. *coli* ***(Enterobacteriaciae)***						
Diseases	Character	Hab/Trans	Pathogenesis	Diagnosis	Treatment	Prevent
Most common **UTI, Gm- sepsis, traveller's diarrhea.** 2nd most common cause of **Neonatal meningitis.** **Enterotoxigenic** strains: Do NOT invade! **heat labile** enterotox binds **GM1 ganglioside** receptor, activates adenylate cyclase via ADPribosylation of G protein. (like *Cholera tox*) **Watery diarrhea.** **Enterohemorragic**: **verotoxin** inhibits 60s ribosome (like *Shigella)* **Bloody diarrhea. 0157:H7 type** causes **hemolytic-uremic syndrome** (anemia, thrombocytopenia, renal failure) associated w/ fast food outbreaks **Enteroinvasive:** factor mediated **invasion** of epithelial cells, sepsis. **Bloody diarrhea with WBCs.**	As other *enterobacteriaciae* family	Normal flora, but need virulence factors to cause disease.	**Pathogenisis by pilus and enterotox, capsule,** and **endotoxin.** Serotype ID by **O,H,K antigens**	**Ferments lactose,** unlike *Salmonella, Shigella*	G3 **Cephalosporin**	No vaccine
Salmonella ***(Enerobacteriaciae)***						
S. *enteritidis* causes **gasteroenteritis** via Cholera like tox. **Large inoculum** needed. (Peptic acid kills) Tx symptoms. **S.*typhi* –Typhoid fever**, init by asymptomatic infection of gut phagocytes and dissemination to liver, **Gall bladder** (carrier state), Fever, RLQ abdominal pain, **rose spots**. Tx **Cipro or ceftriaxone.** **S. *cholerae-suis***- Gm- **sepsis.** Esp patients with **Sickle cell** (risk for **osteomyelitis** b/c func. **Asplenia**)	As other *enterobacteriaciae* family	Normal flora of *animals*. Contamination food, **poultry / eggs**	K anitgen/Vi antigen **Flagella antigenic variation**	**Does NOT** ferment **lactose.** Production of H_2S gas distinguish from *Shigella.*	S. *typhi*- by **Cipro or ceftriaxone**	Hand washing, cooking, water chlorination

ENTERIC *(INTESTIAL disease)*						***Gm- Rods***
Shigella (Enterobacteriaciae)						
Diseases	Characteristics	Habitat/Transmission	Pathogenesis	Diagnosis	Treatment	Prevention
Enterocolitis (dysentary) by S.*dysentariae,* S.*sonnei,* S. *flexneri,* S. *boydii*	Nonmotile **Small innoculum <100 bugs**	Not normal flora. Humans only host. 4Fs: fingers flied food feces (fecal-oral)	Distal ileal and colonic mucosal **invasion** and cell death. Does NOT enter bloodstream (unlike *Salmonella*)	**NO H_2S gas, nonmotile. Non lactose** fermenting on EMB, MacConkey's agar **PMNs in smear** w/ fever suggest invasive bug.	Fluid replacement, avoid antiperistaltic drugs which prolong excretion of organism.	
Vibrio (Not Enterobacteriaciae)						
Cholera - Massive watery diarrhea (Rice water stool) like enterotoxic E.*coli* V.*parahemolyticus* is a marine bug in contaminated raw seafood. Japan	**Comma shaped, single flagella. Large innoculum needed.**	Infects humans only, **transmission** by **fecal-oral**.	Mucinase aided colonization of small intestine, **bipartite enterotox:** binds **GM1 gangliosides** on enterocyte, **ADP-ribosylation of G protein**. (like ETEC)	Diagnosis clinically in endemic areas: Asia, Africa, Latin America.	Oral rehydration	No effective vaccine.
Campylobacter (Not Enterobacteriaciae)						
More frequently causes **enterocolitis than *Salmonella* *or* *Shigella.*** Can cause **bloody diarrhea**	**Comma or S-shaped, Microaerophilic, urease negative**	Domestic animals via fecal oral, unpasteurized milk	Probably enterotoxin	Blood agar w/antibiotics, C.*jejuni* **grows at 42C, produces oxidase**, nalidixix acid sensitive C.*intestinalis* grows at **25C, oxidase neg,** resistant to nalidixic acid	Antibiotics	No Vaccine
Helicobacter *pylori* ***(Not Enterobacteriaciae)***						
Gastritis, peptic ulcer, risk factor **Gastric carcinoma**	Urease + (protects from stomach acid)	Fecal-oral.	Attaches to gastric mucosa, mediated by NH3 production, host inflammatory response		**Bismuth sulfate, tetracycline, metronidazole**	No vaccine.

ENTERIC *(EXTRAINTESTIAL disease)*						***Gm- Rods***
Klebsiella-Enterobacter-Serratia (Enterobacteriaciae)						
Diseases	Characteristics	Habitat/Transmission	Pathogenesis	Diagnosis	Treatment	Prevention
Opportunistic pathogens cause **UTI, pneumonia,** usually nosocomial *Klebsiella* is nonmotile, with capsule, **mucoid** colony appearance. *Klebsiella* pneumo renowned for severity, bloody "**currant jelly**" sputum, lung cavitations. *Serratia*- **bright red pigment. Nosocomial**- Ab resistant	All ferment **Lactose** K.*pneumoniae,* E.*cloacae,* S.*marcescens* difficult to distinguish clinically	Large intestine, soil water		**Ferment lactose** on EMB, MacConkey's agar		No vaccine
Proteus-Providencia-Morganella (Enterobacteriaciae)						
Community and **nosocomial UTI, b/c high motility** (important species: *Proteus mirabilis, Proteus vularis Providencia rettgretii* M. *morganii*)	**Non** lactose fermenting, **urease +** (alkalinizes urine) Only enterobac that makes **phenylalanine deaminase**	Large intestine, soil water		**Swarming** appearance on blood agar. Use antigens from *Rickettsiae* cross react with *Proteus.* P.*mirabilis* is **indole neg** unlike others of this group.		No vaccine
Pseudomonas (Not Enterobacteriaciae)						
P *aeruginosa*: opportunistic, nosocomial: Pneumonia, osteomyelitis, burn infections, sepsis, UTI, endocarditis, **malignant otitis externa,** corneal infections. **P. *cepacia*** colonizes CF patients	**Strict aerobe, Not glucose fermenting, Not reduce nitrates, oxidase +**	Normal flora of **colon**.	Exotox like C.*diptheriae* (**ADP-reibosylation)**	Produces **pyocyanin, pyoverdin**	Highly resistant. Combo pipercillin, ticarcillin and aminoglycoside. **Ceftazidime**	
Bacteroides fragilis (Not Enterobacteriaciae)						
Peritoneal abscesses. Growth favored by growth w/ facultative anaerobes to exhause local oxygen	**Anaerobic, non sporeforming, non LPS, polysaccharide capsule.** No exotox, No LPS	**Predominant** flora of **colon.** NOT communicable. Exits colon via break in mucosa (Chronic disease, PID, trauma)	Polysaccharide capsule provides virulence factor		Treat as **mixed** infection. **Clindamycin, or metronidazole**	No Vaccine

RESPIRATORY						*Gm- Rods*
H. Influenzae ***(chocolate agar w/ heme and NAD)***						
Diseases	Characteristics	Habitat/Transmission	Pathogenesis	Diagnosis	Treatment	Prevention
Leading cause of **meningitis** in kids. Peak at 6m to 1 yr. (decline in maternal IgG, inability of infants to mount attack vs. polysaccharide capsule) Fatal **epiglottitis** by type **B** *influenzae.*	**Coccobacillus w/** polysaccharide **Capsule**	Upper respiratory tract, respiratory droplets	**ONLY encapsulated** forms like type B cause invasive disease. Nonencapsulated cause URI, pneumonia in pts with preexisting lung disease (COPD). **IgA protease,**	**Chocolate agar, w/ heme and NAD.** **Quellung rxn** "Hmmmm Chocolaaate!"  **H.*Simpson***	**Rifampin** prevents meningitis and transmission from close contacts b/c **secreted into saliva** better than Ampicillin	HIB vaccine of **capsular polysaccharide conjugated to carrier protein.**
Legionella pneumophilia ***(Cysteine and Iron agar)***						
Atypical pneumonia with **high fever, nonproductive cough**(differentiate from *Mycoplasma,* influenza, psittacosis, Q fever)	Poor gm stain	Airborne from water sources. Smoking EtOH, Immunosuppressed are at risk.		High concentration **Error! No table of figures entries found.**of **cysteine and iron**. Urine antigen test. Suspect when inc. **PMNs** with no organisms!	**Erythromycin** (also good for *Mycoplasma)*	Disinfect water sources
Bordetella pertussis ***(Bordet-genou agar)***						
Whooping cough- acute tracheobronchitis with **URI symptoms, paroxysmal hacking cough** 1-4 wks, **copious mucus**	Small gm- rods	Airborn droplets **(highly contagious)**	**Polysaccharide capsule and pili** are essential for virulence. Does NOT invade. **Pertussis tox (ADP-ribosylation), and tracheal cytotoxin.**	Culture on **Bordet-genou** agar. Ab agglutination, stain	Erythromycin reduces complications, doesn't change clinical course. Resp tract already damaged.	Killed **B.*pertussis*** vaccine 2,4,6 months, Boosters at age 1, school. **Acellular** vax for booster only.

ZOONTIC						*Gm- Rods*
***Brucella** (virulent, facultative intracellular, tx: aminoglycoside)*						
Diseases	Characteristics	Habitat/Transmission	Pathogenesis	Diagnosis	Treatment	Prevention
Brucellosis- influenza like syndrome w/ **undulating fever**(higher during day, lower at night). Lymphadenopathy, H/Smegaly, no boboes/ulcers.	Small gm- rods	Animal reserviors: B *melitensisi* (goats/sheep) B. *abortus* (cattle) B. *suis* (pigs) **Non pasteurized milk products**(travelers), **through skin** (meat packers, vets, farmers)	Organisms localize in **RES**. Persist in macrophages, induce granulomas	Serology, biochemistry	Antibiotics	**Animal vaccination, pasteurization.** No Human vaccine.
***Francisella tularensis** (virulent, facultative intracellular, tx: aminoglycoside)*						
Tularemia- influenza like syndrome w/ **ulceroglandular lesions** (hole in skin, black base, swollen LN, draining pus)	Small gm- rods	Ubiquitous in US in **wide variety of animals. Tick/mite vectors.** Humans as accidental dead end hosts by **bites** or **animal skin handling.**	Enters through skin, localizes in **RES**. Persist in macrophages, induce granulomas	Serology	Streptomycin	**Live attenuated vaccine** (like BCG)
***Yersinia pestis** (virulent, facultative intracellular, tx: aminoglycoside)*						
Plague- Hematogenous spread **results in fever myalgias, hemorrhage. Also septic shock, pneumonia.**	Small gm- rods with bipolar stain	Endemic in prairie dogs in US, 99% cases in SE Asia. Rats/flease in **urban centers. Also wound-person respiratory droplets.**	Bacteria spread to **regional LN, enlarged tender buboes.**	Immunoflorescence	Antibiotics	Quarantine. No Vaccine.
Pasteurella multocida						
Cellulitis rapid onset at bite site. **Osteomyelitis as complication**. **Sutures** predispose to infection	Small gm- rods	**Normal flora of dogs and cats.** Transmitted to humans by animal bite.		Presumptive Dx by rapid onset **cellulitis** at animal bite.	Penicillin	Ampicillin prophylax.

MYCOBACTERIA *(Obligate aerobe, facultative intracellular organisms)* *Acid Fast Rods*

M. tuberculosis

Diseases	Character	Habitat/Transmission	Pathogenesis	Diagnosis	Treatment	Prevention
Tuberculosis: chronic low grade fever, night sweats, productive cough, hemoptysis, weight loss. Elderly, immunocomp, malnourished at risk.	Obligate aerobe, intracellular, infect M0, persist for years. Mycolic acid walls	**Only infects humans.** Respiratory aerosol. Infects M0s in **mid/lower lobes**, init granuloma formation, widely disseminate the infection. T cells help M0 kill some intracellular mycobacteria at expense of bystander cell damage. Result: necrotic host cells, viable mycobacteria. Walled off w/ giant cells, fibroblasts, collagen, calcification to form **granuloma** or **tubercle.** This **1' infection** = **Ghon focus** on CXR (when including Ca tubercles in perihilar lymph nodes = **Ghon complex.**) Reactivation prefers **upper lobe (obligate aerobe)** of lung. Reactivation can infect any organ. Cervical LN (**scrofula),**spine **(Pott's disease.)**	**Mycolic acids** confer acid fastness. **WaxD** is active ingredient in **Freund's adjuvant. Cord factor** is **virulence factor** (mycoside= 2 mycolic acids + disaccharide)	**PPD** tests for **prior exposure** or to **BCG vax.** Positive test if **both redness, induration 48-72 hr** after injection (DTH rxn.) Note: *candida* and mumps as controls in immunocomp. **Acid fast stain. NaOH** concentrate on **Lowenstein-Jensen medium**. Slow culture, 6-8 wks. **Niacin production**	**Prolonged, multiple Tx. (INH, rifampin, pyrazinamide, ehtambutol)** **Protracted tx** b/c: intracellular life cycle, granuloma blocks penetration of drug, metabolically inactive mycobac persist in lesion	Chemoproph ylax w/ INH (watch hepatotox in people >35 y.o.) **Live attenuated M.*bovis* (BCG)** induces some protective immunity.

M. avium- intracellulare

Clincal TB indistinguishable from M *tuberculosis* in AIDS.	**Atypical mycobacterium**	Found in water, soil, **not pathogenic** in guinea pigs (infects birds)			**Azithromycin Clarithromycin**	Macrolide prophylax when CD4 count < 50

M. leprae

Leprosy- preferential growth in < 37C, **skin, superficial nerves.** **<u>Tuberculoid- good</u>** cellular immune response, **few** AFB, **granulomas, positive** lepromin skin test. Anethetized skin lesions and thickened superficial nerves. **<u>Lepromatous- poor</u>** cellular immune response, **lots** of organisms, **foamy histiocytes**, **negative** lepromin skin test (poor response.) Skin lesions, lion facies. Skin anesthesia, bone resorption, skin thickening, **disfiguring.**	Never has been grown in lab.	**Brazil, India, Sudan** Humans only natural hosts. **Mouse footpad and armadillo** growth only. Transmission by nasal secretions, skin lesions to persons with **prolonged** contact w/pts.	Intracellular replication (skin histiocytes, endothelial cells, Schwann cells)		**Rifampin Dapsone** Up to **2 years!**	Prophylax exposed persons with **Dapsone.**

ACTINOMYCETES						***Gm- Branching Rods***
A. israelii						
Diseases	Characteristics	Habitat/Transmission	Pathogenesis	Diagnosis	Treatment	Prevention
Actinomycosis- hard non-tender swelling, drains pus through sinus. (abscess that spreads to neck, chest, abdomen.)	Aanerobic Gm- branching rods	**Normal anaerobic flora oral cavity/GI tract.** Not communicable.	**Invasion after** local trauma **(risk factor for anaerobic growth)**	**Anaerobic Gm- branching rods, sulfur granules** in pus	**Penicillin**	No vaccine
Nocardia asteroides	***(Acid Fast Branching)***					
Nocardiosis- pneumonia that progresses to abscess formation, sinus tract drainage, dissemination to brain/kidney (immunosuppressed)	Aerobic Gm- branching rods.	**Soil, NOT normal flora**		**Acid fast branching, NO sulfur, aerobic**	**Bactrim** (trimethorprim + sulfamethoxazole)	No vaccine

Mycoplasma pneumoniae	***(No cell wall, poor gm stain)***			***Small free living organism***		
Diseases	Characteristics	Habitat/Transmission	Pathogenesis	Diagnosis	Treatment	Prevention
"Walking pneumonia" (dry nonproductive cough, horrible CST, generally feel well) **Most common pneumonia in young adults** (college students).	Smallest free living organism, **no cell wall** so poor gm stain, resists **penicillins, cephalosporins**. Cell membrane has **chol** which are not in other bacteria. "Fried egg" colonies on **Eaton's agar.** ("**Eat Fried Eggs w/ chol"**)	**Respiratory droplets.** Attaches but does NOT invade respiratory epithelium, like B.*pertussis*.	Pathogenic only for humans. Arrests cilliary motion, induces epithelial cell necrosis. Cross reactive antigens induce anti RBC autoantibodies (**cold agglutinins.**)	Elevated titer of cold agglutinins or specific anitbodies	**Erythromycin Tetracycline**	No vaccine