Domain: Bacteria

I. Phylum: Proteobacteria
   A. Class: α-proteobacteria
      1. Order: Rickettsiales
         a. Genus: *Ehrlichia*
            i. Gram-negative rod or coccobacilli
            ii. Intracellular pathogens that live in white blood cells
            iii. Transmitted to humans by ticks, cause erlichiosis
         b. Genus: *Rickettsia*
            i. Gram-negative rod or coccobacilli
            ii. Enter the cell by induced phagocytosis, escaping into the cytoplasm
            iii. Species
               a. *R. prowazekii* – typhus transmitted by lice
               b. *R. typhi* – typhus transmitted by fleas
               c. *R. rickettsii* – Rocky Mountain Spotted Fever, transmitted by ticks.

      2. Order: Rhizobiales
         a. Genus: *Bartonella*
            i. Gram-negative bacillus
            ii. *B. henselae* – causative agent of Cat Scratch Fever
         b. Genus: *Brucella*
            i. Small nonmotile Gram-negative coccobacilli
            ii. Cause brucellosis, and survive phagocytosis

   B. Class: β-proteobacteria
      1. Order: Burkholderiales
         a. Genus: *Burkholderia*
            i. Formerly grouped with the *Pseudomonas*
            ii. Gram-negative, motile bacillus
            iii. Species
               a. *B. cepacia* – common hospital acquired infections resulting from its ability to grow in very diverse conditions.
               b. *B. pseudomallei* – causes melioidosis, endemic to SE Asia and Australia
         b. Genus: *Bordetella*
            i. Nonmotile aerobic Gram-negative bacillus
            ii. *B. pertussis* – causative agent of pertussis, whooping cough.

      2. Order: Neisseriales
         a. Genus: *Neisseria*
            i. Gram-negative diplococci
            ii. Species
               a. *N. gonorrhoeae* – sexually transmitted disease
b. *N. meningitides* – agent of meningitis

C. Class: γ-proteobacteria

1. Order: Thiotrichales
   a. Genus: *Francisella*
      i. Small, pleomorphic bacteria that only grow on complex media supplemented with things such as blood.
      ii. *F. tularensis* – causative agent of tularemia, a prospective bioweapon with a very low infective dose.

2. Order: Legionellales
   a. Genus: *Legionella*
      i. Gram-negative bacillus
      ii. Common in aquatic environments (i.e. AC units)
      iii. Intracellular pathogens
      iv. *L. pneumophila* – causes legionellosis (Legionnaires disease)
   b. Genus: *Coxiella*
      i. Intracellular pathogen
      ii. Transmitted by air or contaminated milk
      iii. Produces a spore-like body that is resistant to insult
      iv. *C. burnetti* – causes Q fever

3. Order: Pseudomonadales
   a. Genus: *Moraxella*
      i. Strictly aerobic coccobacillus
      ii. Infectious agent in conjunctivitus
   b. Genus: *Pseudomonas*
      i. Motile, Gram-negative, motile bacillus
      ii. Very nutritionally diverse
      iii. Opportunistic pathogens
      iv. High level of antibiotic resistance present.

4. Order: Vibrionales
   a. Genus: *Vibrio*
      i. Slightly curved, gram-negative bacillus
      ii. Species
         a. *V. cholerae* – cholera
         b. *V. parahaemolyticus* – gastrointestinal pathogen, common in shellfish.

5. Order: Enterobacteriales (enterics – food poisoning)
   a. Genus: *Citrobacter*
   b. Genus: *Enterobacter*
   c. Genus: *Escherichia*
      1. *E. coli* – potential food poisoning organism, and classical model system
   d. Genus: *Klebsiella*

e. Genus: *Proteus*
   1. Easy to distinguish on plates from its swarming behavior

f. Genus: *Salmonella*

g. Genus: *Serratia*

h. Genus: *Shigella*

i. Genus: *Yersinia*
   1. *Y. pestis* – causative agent of bubonic plague, a potential bioweapon and the most likely disease that caused the Black Death of European history (resulting in the death of close to half the population of Europe)

6. Order: Pasteurellales
   a. Genus: *Haemophilus*
      1. *H. influenzae* – causes a type of pneumonia, meningitis, and earaches.
      2. *H. ducreyi* – causes the sexually disease Chancroid.
   b. Genus: *Pasteurella*
      1. Causes sepsis and fowl cholera

D. Class: δ-proteobacteria
   1. Order: Bdellovibrionales
      a. Genus: *Bdellovibrio*
         i. A bacteria that preys on other bacteria but entering into their periplasm and digesting them.

E. Class: ε-proteobacteria
   1. Order: Campylobacterales
      a. Genus: *Campylobacter*
         i. Motile, microaerophilic vibrios
         ii. *C. fetus* causes abortions in livestocks
         iii. *C. jejuni* is one of the leading causes of foodborne illness.
      b. Genus: *Helicobacter*
         i. Motile, microaerophilic vibrios
         ii. Survives the acids in the human stomach
         iii. *H. pylori* – causative agent of stomach ulcers

II. Phylum: Firmicutes (Low GC Gram-Positive Bacteria)
   A. Order: Clostridiales
      1. Genus: *Clostridium*
         A. Endospore forming anaerobic bacillus
         B. *C. tetani* – tetanus, rigid paralysis
         C. *C. botulinum* – botulism, flaccid paralysis
         D. *C. perfringens* – common cause of gangrene
   B. Order: Mycoplasmatales
1. Genus: *Mycoplasma*
   A. Wall-less bacteria, highly pleomorphic
   B. Very small, ranging from 0.1 to 0.25 μm
   C. *M. pneumoniae* – mild form of pneumonia

C. Order: Bacillales
1. Genus: *Bacillus*
   A. Endospore forming, aerobic bacillus
   B. *B. anthracis* – causative agent of anthrax, a potential bioweapon used in the 2001 mail attacks.
2. Genus: *Listeria*
   A. Aerobic bacillus
   B. *L. monocytogenes* – psychrophile that contaminates food
3. Genus: *Staphylococcus*
   A. “Grape Clusters”
   B. *S. aureus* – quickly develops resistance to antibiotics and can invade tissues

D. Order: Lactobacillales
1. Genus: *Enterococcus*
   A. Gram-positive cocci
   B. Hardy organisms that reside in stool and are common contaminants on surfaces.
   C. Highly resistant to most antibiotics
2. Genus: *Streptococcus*
   A. Gram-positive cocci that appear in chains
   B. Produce a number of exotoxins (toxins excreted from the cell)
   C. Responsible for a number of diseases including strep throat (*S. pyogenes*) and pneumonia (*S. pneumoniae*)
3. Genus: *Lactobacillus*
   A. Gram-positive bacillus
   B. Common commensal organisms in humans
   C. Practically used for the production of many commercial foods.

III. Phylum: Actinobacteria (High GC Gram-Positive Bacteria)
A. Order: Actinomycetales
1. Genus: *Actinomyces*
   a. Facultative anaerobe, common in the mouth
   b. *A. israelii* – causes a tissue destroying disease called actinomycosis
2. Genus: *Corynebacterium*
   a. Highly pleomorphic cells, commonly referred to as “Chinese Character Morphology”
   b. *C. diptheriae* – Diphtheria (“Whooping Cough”)
3. Genus: *Gardnerella*
   a. Highly pleomorphic and gram-variable
b. *G. vaginalis* – common cause of vaginitis

4. Genus: *Mycobacterium*
   a. Aerobic, gram-positive bacillus
   b. Covered in a waxy layer of mycolic acid
   c. Slow growth rate, as many as 6-8 weeks to grow in culture
   d. Two important human pathogens
      i. *M. tuberculosis* – tuberculosis
      ii. *M. leprae* - leprosy

5. Genus: *Norcardia*
   a. Similar to *Actinomyces*, producing rudimentary filaments
   b. Pathogenic species produce mycolic acids
   c. *N. asteroides* – produces a persistent pulmonary infection.

6. Genus: *Streptomyces*
   a. Common soil bacterium that produces aerial filaments
   b. Produces a number of antibiotics
   c. Nearly 500 identified species

7. Genus: *Propionibacterium*
   a. Produces propionic acid, used to make Swiss cheese
   b. *P. acnes* – implicated in the formation of acne

IV. Phylum: Chlamydiae
   A. Order: Chlamydiales
      1. Genus: *Chlamydia*
         a. *C. trachomatis* causes two distinct diseases
            i. Nongonococcal urethritis – the most prevalent STD in US.
            ii. Trachoma – preventable blindness in babies
         2. Genus: *Chlamydiophila*
            a. *C. psittaci* – causes psittacosis (common among bird-lovers)
            b. *C. pneumoniae* – causes a mild pneumonia
      3. Both genera produce elementary bodies as the infective agents.
      4. Both genera have a complex life-cycle allowing for differentiation
      5. Intracellular pathogens, with direct human/human transmission

V. Phylum: Spirochaetes
   A. Order: Spirochaetales
      1. Genus: *Borriela*
         a. Cause relapsing fevers and Lyme disease
      2. Genus: *Leptospira*
         a. Excreted in the urine of domesticated pets.
      3. Genus: *Treponema*
         a. *T. pallidum* – causes syphilis
      4. Possess axial filaments (endoflagella) allowing for rapid movement
VI. Phylum: Bacteroidetes
   A. Order: Bacteroidales
      1. Genus: Bacteroides
         a. Heavily contaminating feces
         b. Frequent cause of wound infections

VII. Phylum: Fusobacteria
   A. Order: Fusobacteriales
      1. Genus: Fusobacterium
         a. Pointed end bacteria
         b. Common cause of dental abscesses