PLAGUES IN MAN

THE BACTERIA

I. INTRODUCTION TO THE BACTERIA (EUBACTERIA)
   A. > 20 GROUPS (PHYLA) [WE WILL DISCUSS FOUR]
   B. PEPTIDOGLYCAN CELL WALLS (ALMOST ALL)
   C. ESTER-LINKED PHOSPHOLIPIDS
      [THE OTHER GROUP OF PROKARYOTES, THE ARCHEA, HAVE EHTER-LINKED LIPIDS]
   D. SIMILAR RNA POLYMERASE (FIVE SUBUNIT, SINGLE ENZYME)
   E. FORMYLMETHIONINE AS STARTING AMINO ACID
   F. RIBOSOMES UNIQUE TO BACTERIA
   G. GENOMES ARE SINGLE, CIRCULAR DS DNAs (2 EXCEPTIONS KNOWN)
      1. GENOME SIZES
         a. LARGEST-*MYXOCOCCUS XANTHUS* - 9450 Kbp
         b. SMALLEST-*MYCOPLASMA GENITALIUM* - 585 Kbp [SEQUENCED]
         c. *E. COLI*'S GENOME IS 4700 Kbp (3×10^9 D) [SEQUENCED]
      2. GENOME ORGANIZATION
         a. SINGLE GENES- EXCEPTIONS ARE rRNA CLUSTERS & tRNAs
         b. OPERONS COMMON
      3. MANY PLASMIDS AND TRANSPOSONS [SELFISH DNA]

II. THE PROTEOBACTERIA (PURPLE BACTERIA or GRAM NEGATIVE BACTERIA)
   A. LARGEST OF MAJOR GROUPS
      1. FIVE SUBDIVISIONS
      2. PHOTOSYNTHETIC AND NON-PHOTOSYNTHETIC FORMS
      3. CORRESPONDS TO GRAM NEGATIVE BACTERIA
         a. THIN PEPTIDOGLYCAN LAYER
         b. HAVE TWO MEMBRANES - PLASMA AND OUTER MEMBRANE
         c. LIPOPOLYSACCHARIDE (ENDOTOXIN) IN OUTER MEMBRANE
      4. MOST HUMAN PATHOGENS
      5. MANY PHOTOSYNTHETIC FORMS (ALL ANOXYGENIC)
   B. THE ALPHA SUBDIVISION
      1. IMPORTANT PLANT MICROBES - EG. *RHIZOBIUM, AGROBACTERIUM*
      2. NONSULFUR PURPLE PHOTOTROPHS - *RHODOBACTER*, ETC.
      3. HOME OF THE *RICKETTSIA*
      4. SOURCE OF MITOCHONDRIAL SYMBIONT
      5. TWO GROUPS OF PSEUDOMONADS
   C. THE BETA SUBDIVISION
      1. MORE NONSULFUR PURPLE PHOTOTROPHS - EG. *RHODOCYCLUS*
      2. THREE GROUPS OF PSEUDOMONADS
      3. SPIRILLA: *SPIRILLUM, RHODOCYCLUS*
      4. THE *NEISSERIA & BORDETELLA*
   D. THE GAMMA SUBDIVISION - BEST CHARACTERIZED
      1. THE SULFUR PURPLE BACTERIA (EG. BEGGIATOA, CHROMATIUM)
      2. THE ENTERICS (*E. coli*) & RELATIVES
      3. THE VIBRIOS & RELATIVES
      4. THE FLUORESCENT *PSEUDOMONAS* (*P. aeruginosa*)
      5. *LEGIONELLA, COXIELLA, FRANCISELLA & WOLBACHIA*
   E. THE DELTA SUBDIVISION-NO PHOTOTROPHS; SULFUR (SO_4) REDUCERS; *DESULFOVIBRIO, DESULFOBACTER, MYXOCOCCUS*
   F. THE EPSILON SUBDIVISION - NO PHOTOTROPHS; TWO PATHOGENIC GROUPS-*HELICOBACTER* (ULCERS) & *CAMPYLOBACTER* (DIARRHEA)

THE BACTERIA (CONTINUED)

III. THE GRAM POSITIVE BACTERIA (FIRMICUTES & ACTINOBACTERIA)
- A. DISTINCTIVE CHARACTERISTICS
  - 1. CELL WALL IS THICK PEPTIDOGLYCAN (TEICHOIC ACIDS)
  - 2. ENDOSPORE FORMERS (BACILLUS AND CLOSTRIDIUM)
  - 3. WALL-LESS FORMS - THE MYCOPLASMAS
  - 4. THE ACID FAST BACTERIA - MYCOBACTERIA AND RELATIVES
- B. TWO MAJOR GROUPS
  - 1. THE LOW GC GRAM POSITIVE BACTERIA (THREE CLASSES)
    - a. THE BACILLI (BACILLALES AND LACTOBACILLALES)
      - 1) *BACILLUS* - THE AEROBIC SPORE FORMERS
      - 2) *STREPTOCOCCUS*
        PNEUMOCOCCUS & PYOGENES
      - 3) *STAPHYLOCOCCUS*
        AUREUS & EPIDERMIDUS
      - 4) *LISTERIA*
    - b. THE CLOSTRIDIA
      - 1) *CLOSTRIDIUM* - THE ANAEROBIC SPORE FORMERS
        PERFRINGENS, BOTULINUM & TETANI
      - 2) *HELIOBACTERIUM* - PHOTOSYNTHETIC
    - C. THE MYCOPLASMA
      - a) THE WALL-LESS BACTERIA
      - b) SMALLEST GENOMES
      - c) SOME CAN BE CULTURED
        M. PNEUMONIA
  - 2. THE HIGH GC GRAM POSITIVE BACTERIA
    - a. DISTINCTIVE PROPERTIES
      - 1) FILAMENTOUS FORMS
      - 2) MANY SOIL BACTERIA
        [SMELL OF RICH SOIL IS DUE TO STREPTOMYCETES]
      - 3) THE ACID FAST BACTERIA
        LIPOPHILIC SURFACE
        UNUSUAL LIPIDS - THE MYCOLIPIDS
      - 4) MANY GRAM VARIABLE SPECIES
    - b. THE *ACTINOMYCES & STREPTOMYCES*
    - c. THE *ARTHROBACTERS & MICROCOCCUS*
    - d. THE *CORYNEBACTERIUM*, *NOCARDIA*, *MYCOBACTERIUM*

IV. *CHLAMYDIA* - OBLIGATE INTRACELLULAR PARASITES
- A. ONLY THREE SPECIES IN GROUP
- B. *TRACHOMATIS* CAUSES STD AND CONJUNCTIVITIS
- C. *PSITTACI* CAUSES PSITTACOSIS (PARROT FEVER)
- D. LIFE CYCLE:
  ELEMENTARY BODY - NON GROWING "SPORE-LIKE"
  RETICULATE BODY - VEGETATIVE CELL
  GIVEN UP MUCH OF METABOLISM - CANNOT MAKE ATP
- E. SMALL GENOME -- 1450 Kbp

V. THE SPIROCHETES
- A. SPIRAL ORGANISMS WITH A SHEATH & AXIAL FILAMENTS
- B. SLOW GROWING, AQUATIC FREE-LIVING OR PARASITIC
- C. SEVERAL HUMAN PATHOGENS
  - 1. *TREPONEMA PALLIDUM* -- SYPHILIS
  - 2. *BORRELIA BURGDORFERI*-- LYME DISEASE- LINEAR GENOME