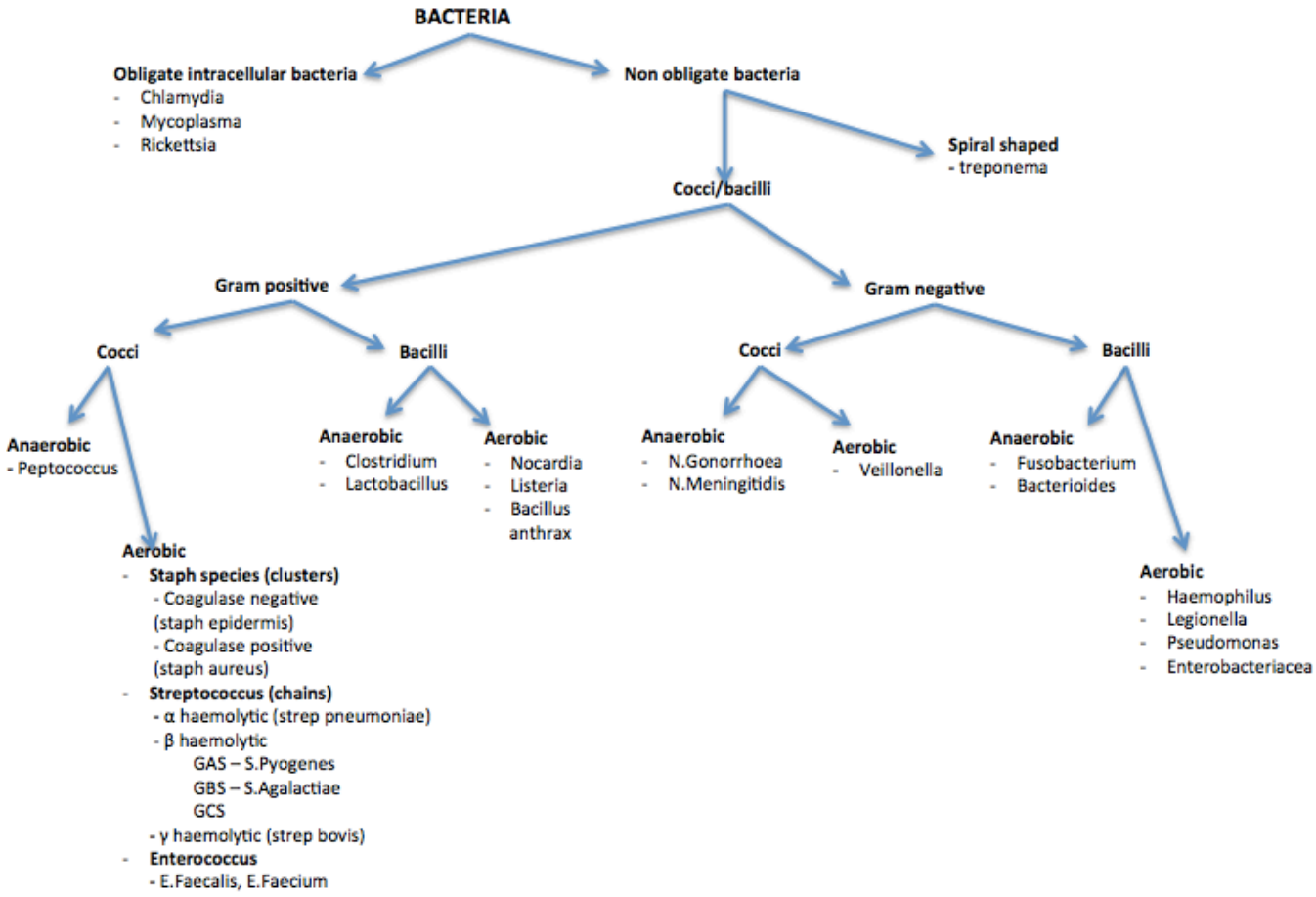
**Q10 Classify bacteria according to the Gram stain system and the shape of the bacteria, and give two examples for each classification (40% of marks). Outline the different mechanisms of bacterial antibiotic resistance and an antibiotic for which that mechanism may apply (60% of marks) (March 2014)**

Bacterial classification:




**Mechanisms of resistance:**

- Alteration in target site
  - Production of an alternative enzyme for that which the antibiotic inhibits (Eg, MRSA synthesizes an additional penicillin binding protein that enables it to continue cell wall synthesis in the presence of a beta lactam drug)
  - Overproduction of the target of the antibiotic

- Alteration in access to target site
  - Reduced binding of the antibiotic (eg, VanA and VanB vancomycin resistance involves a gene mutation leading to decreased affinity of vancomycin for the binding sites of peptidoglycan precursors; changes to the DNA-binding surface of DNA supergyrase infers resistance against ciprofloxacin)
  - Reduced uptake of the antibiotic (eg, transport defect or membrane impermeability to gentamicin, alteration of porins through which beta lactams must diffuse in gram negative outer membranes)
  - Active efflux of the antibiotic (eg, active transport of ciprofloxacin out of the bacterial cell)

- Enzymes produced against the antibiotic
  - Beta lactamases and cephalosporinases which hydrolyse and inactive beta lactam antibiotics
  - Multiple enzymes have been identified that block aminoglycoside, including acetyltransferase, adenyltransferase, and phosphotransferase)