

For exam: bacterial genomics, insect endosymbiosis, nitrogen cycle, plant symbionts  
Lectures on Oct. 23, 25, 29 & Nov. 1  
Ch. 15 all  
Ch.17 p586 to 591  
Ch 19 656-666  
Ch 31 989-991

Example questions:

1. Lateral gene transfer (LGT) can be divided in four main steps: release of genetic information from a donor, targeting of genetic information to a recipient, uptake, and successful incorporation of the genetic information by the recipient. The last step, successful incorporation, can involve homologous recombination, non-homologous (illegitimate) recombination, or episomal replication of the transferred genetic information. Give a specific example of LGT for each of these 3 types of successful incorporation of the genetic information by the recipient.
2. Primary endosymbionts of aphid insects, including *Buchnera* species, are characterized by severe genome reduction, with genome sizes range from 450 to approximately 800 kb compared to 5 to 6 Mb for *Escherichia coli* genomes. (A) Which features of endosymbiont biology account for this marked genome reduction? Explain your reasoning. (B) Describe an evolutionary model that explains why *Buchnera* of different aphid lineages differ in genome size and gene content.
3. The nitrogen cycle involves the interactions of many microbial species with one another, and other organisms, sometimes symbiotically. Several key processes in the oxidative-reductive cycling of nitrogen that only prokaryotes can catalyze.
  - a. Define and describe the importance of the following processes in nitrogen cycling (OK to sketch out the reactions):
    - i. Denitrification
    - ii. Nitrification
    - iii. Nitrogen Fixation
  - b. Pick one of the above processes where microbe-microbe, microbe-animal, or microbe-plant symbiotic interactions are involved/important and describe how and why. Give an example of some of the organisms involved, and the specifics of the interaction.