GENTERAL GENETICS (BIOL 2510)
WINTER QUARTER 2014
Study Guide Exam 3

Chapter 8 (Bacterial and Viral Genetics)

What are plasmids?
A genetic structure in a cell that can replicate independently of the chromosomes (extra-chromosomal), typically a small circular DNA strand in the cytoplasm of a bacterium or protozoan.

Why types of genes do they carry in nature?
Contains genes for "fertility" factor antibiotic resistance, and toxin genes.

What are episomes?
Plasmids that can integrate into bacterial chromosomes.

What are the *OriV*, *OriT*, and *OriC* sequences?
OriV-An origin of replication is a sequence of DNA at which replication is initiated on a chromosome, plasmid or virus. For small DNAs, including bacterial plasmids and small viruses, a single origin is sufficient. Larger DNAs have many origins, and DNA replication is initiated at all of them

OriT-The fixed point on an F plasmid (factor) where one strand is nicked (by an endonuclease) and transferred to a recipient cell

OriC-replication origin; in initiation step of bacterial DNA replication

What is horizontal gene transfer?
Independent of reproduction, involves the transfer of DNA between different genomes.

How does it differ from vertical gene transfer?
Horizontal gene transfer is asexual.

Compare and contrast conjugation, transformation, and transduction.

Conjugation- a bacterium transfers a copy of some or all of its dna to another bacterium, giving the second bacterium genetic information it did not have before.

Transformation-A bacterial cell takes up naked DNA from the environment and new genes are acquired.

Transduction- Transfer of DNA from one cell to another by way of a bacteriophage (phages that infect bacteria can transfer genes from one host cell to another). Adds new chromosomal alleles to recipient cell (recombination).

Describe the major events associated with conjugation. What protein complexes are involved?

Conjugation:
-leads to horizontal transfer of genetic material
-entire genome can be transferred

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-direct exchange of DNA through sex pilus
-fertility factor (F+) donor passes DNA to recipient (F-)

Protein Complexes involved:
Relaxosome (cuts, initial step)
Transferosome (make a core in cell wall that plasmid transfers through and pulls protein strand, transfer of genetics between bacteria)

What is an Hfr cell? How is it different from an F+ cell?

High frequency recombinant cell:

A donor cell with the F plasmid integrated into chromosome; it can transfer only part of the chromosome...this is because the origin of transfer is in the middle of the F gene

F+ cell:
Cell with sex pilus; plasmid in cytoplasm

Compare and contrast conjugation between: F+/F- cells and Hfr/F- cells.

What are F′ cells? How can F′/F- conjugation lead to production of a partially diploid cell?
F′ cells occur when F factor removes host DNA during excision. They contain an F factor with some bacterial genes. F′ cells behave like F+ cells.

What is a virus? What is a bacteriophage? What is the difference between a temperate and virulent phage?

Virus-replicating structure made up of nucleic acid surrounded by protein coat.
Bacteriophage-virus that infects bacteria
Virulent phage-reproduces only through lytic cycle and kills host cells
Temperate phage-undergo either lytic or lysogenic life cycle

Compare and contrast the lytic and lysogenic life cycles.

- **Lytic- infect, breakdown cell and produce progeny, lyse to release progeny, VIRULENT (ex: T4)**
- **Lysogenic- infect, phage chromosome inserts into host chromosome, phage DNA reproduced with bacteria (ex: lambda phage)**
- **Temperate- alternate between 2 phases**

Compare and contrast generalized and specialized transduction.
-Generalized integrates just about anywhere in the genome (only lytic cycle)
-Specialized integrates into the same place every time (always pulls the same piece of host genetic material with it and is lysogenic phage)

Describe several examples of horizontal gene transfer in eukaryotes.

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In Eukaryokes evidence of horizontal gene transfer is seen in Chloroplast DNA and mitochondrial DNA. Also in *Wolbachia* which is the most common parasitic/endosymbiotic microbes. Involved nuclear genome transfer

Chapter 11 (Chromosome Structure)

What meant by "higher order DNA structure"?

-solenoids- compaction of nucleosomes into fibers--begin interaction with scaffold

-extended loop- diffuse loops of solenoids anchored to chromosome scaffold, transcriptionally active (euchromatin)

-condensed loop- highly compacted anchored to scaffold, transcriptionally inacive (heterochromatin)

-metaphase chromosomes- tightly compacted- coiled loops and chromosome scaffold

What is supercoiling? What are two kinds of supercoiling?
-winding or unwinding of DNA to shorten it
-torsion is relieved with topoisomerase
-positive/negative supercoiling do same thing

What are topoisomerases? How do these enzymes work?
-Corrects the "over-winding" ahead of replication forks by breaking, swiveling, and rejoining DNA strands
-relaxes double stranded DNA
ex: Gyrases

What is chromatin? What is the difference between heterochromatin and euchromatin?
Chromatin-DNA/protein complex
Heterochromatin- highly condensed/repeating DNA (no protein coding regions)
Euchromatin-loosely packed actin form that is where DNA is transcribed into RNA

Describe the major steps involved in packaging dsDNA into chromosomes (Figure 11.5).
1. Coiling of DNA double helix
2. Coiling of DNA around histone core. histone octamer (+146 bp of DNA) & histone H1 + linker DNA (found in between nucleosomes)
3. Coiling of DNA around histones to make nucleosome cores
4. Coiling of DNA + histone protein + non-histone protein (Solenoids)
5. Condensed Solenoids (Chromatin fiber)
6. Condensed Chromatin fibers (Chromatid)

What are histones? Why do they associate strongly with DNA?
-Globular protein that unused sections of DNA are wrapped around
-have a high content of basic amino acids, gives them a net positive charge (because lysine residue)
-DNA is net negative so histones (+) associate with DNA (-) strongly

What are nucleosomes? Why is the association of nucleosomes with DNA arguably the most important step in DNA condensation?