**Chapter 7**

**The Structure of Prokaryotic Genomes**

* Prokaryotic chromosomes
	+ Main portion of DNA, along with associated proteins and RNA, packaged in 1-2 distinct chromosomes
	+ Prokaryotic cells have a single copy of each chromosome (haploid)
	+ Typical chromosome – circular molecule of DNA in nucleoid
	+ Plasmids
		- Small molecules of DNA that replicate independently
		- Carry information required for their own replication, and often for one or more cellular traits
		- Not essential for normal metabolism, growth, or reproduction
		- Can confer survival advantages
		- Many types of plasmids
			* Fertility factors
			* Resistance factors
			* Bacteriocin factors
			* Virulence plasmids
			* Cryptic plasmids
	+ Nuclear chromosomes
		- Typically have more than one chromosome per cell
		- Chromosomes are linear and sequestered within membrane-bound nucleus
		- Eukaryotic cells often have two copies of each chromosome (diploid)

**Regulation of Genetic Expression**

* Nature of prokaryotic operons
	+ An operon consists of a promoter and a series of genes
	+ Some operons are controlled by a regulatory element called an operator
		- activated by inducers
			* Lactose operon
		- Repressible operons are transcribed continually until deactivated by repressors
			* Tryptophan operon

**Mutations of Genes**

* Mutation – change in the nucleotide base sequence of a genome
* Rare event
* Almost always deleterious
* Rarely leads to a protein having a novel property that improves ability of organism and its descendents to survive and reproduce
* Mutagens
	+ Radiation
		- Ionizing radiation – induces breaks in chromosomes
		- Nonionizing radiation – induces pyrimidine dimers
	+ Chemical Mutagens
		- Nucleotide analogs – disrupt DNA and RNA replication and cause point mutations
		- Nucleotide-altering chemicals – result in base-pair substitution mutations and missense mutations
		- Frameshift mutagens – result in nonsense mutations

**Genetic Recombination and Transfer**

* Exchange of nucleotide sequences often mediated by DNA segments composed of homologous sequences
* Recombinants – cells with DNA molecules that contain new nucleotide sequences
* Vertical gene transfer – organisms replicate their genomes and provide copies to descendants
* Horizontal Gene Transfer Among Prokaryotes
	+ Horizontal gene transfer – donor cell contributes part of genome to recipient cell
	+ Three types
		- Transformation
		- Transduction
		- Bacterial conjugation
	+ Transformation
		- Transforming agent was DNA; one of conclusive pieces of proof that DNA is genetic material
		- Cells that take up DNA are competent; results from alterations in cell wall and cytoplasmic membrane that allow DNA to enter cell
	+ Transduction
		- Generalized transduction – transducing phage carries random DNA segment from donor to recipient
		- Specialized transduction – only certain donor DNA sequences are transferred