



















- 1  **Chapter 11**
Chromosome Structure & Transposable Elements
- 2  **DNA Packing**
 - ▶ E. coli
 - ▶ 1000 x length of cell
 - ▶ Human
 - ▶ 14,000 x length of nucleus
 - ▶
 - ▶ Primary
 - ▶ Nucleotide sequence
 - ▶ Secondary
 - ▶ Double-strand helix
 - ▶ Tertiary
 - ▶ Higher –order folding
- 3 
 - ▶ Relaxed state
 - ▶ 100bp with 10 complete turns
 - ▶ Addition or removal of turns produces strain
 - ▶ Topoisomerases
 - ▶ Positive supercoiling
 - ▶ Over rotation
 - ▶ Negative supercoiling
 - ▶ under rotated
 - ▶ Most common in cells
 - ▶ Proteins prevent rotation of ends
- 4  **Bacterial chromosome**
 - ▶ Nucleoid region
 - ▶ Associated proteins help hold coils
- 5  **Eukaryotic chromosome**
 - ▶ Chromatin
 - ▶ Euchromatin
 - ▶ Heterochromatin
 - ▶ Associated proteins
 - ▶ Histones
 - ▶ Positive charge
 - ▶ Nonhistone chromosomal proteins
 - ▶ Chromosomal scaffold proteins
- 6 
 - ▶ Nucleosome
 - ▶ Histone core
 - ▶ 2 units of each
 - H2A, H2B, H3, H4
 - ▶ & DNA
 - ▶ Chromatosome
 - ▶ Includes H1
 - ▶ Higher-order
 - ▶ 30nm fiber
- 7 
 - ▶ Polytene chromosomes
 - ▶ Drosophila
 - ▶ Chromosomal puffs

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- ▶ Active transcription
- ▶ Active regions of transcription sensitive to Dnase I
- 8  **Centromere**
 - ▶ Importance?
 - ▶ Tandem repeats
 - ▶ Variant H3 protein
 - ▶ Kinetochore
 - ▶ Inhibition of anaphase
- 9  **Telomere Structure**
 - ▶ Chromosome caps
 - ▶ Telomeric sequences
 - 5' -CCCTAA
 - 3' -GGGATT
- ▶
- 10  **Artificial chromosomes**
 - ▶ Centromere, telomeres, origin of replication
 - ▶ YACs
 - ▶ BACs
 - ▶ MACs
- 11  **11.4 classes of sequence**
 - ▶ C value
 - ▶ Amount of DNA per cell
 - ▶ Salamander 20 x more
 - ▶ Trumpet lily 30 x more
 - ▶ *Amoeba dubia* 200 x more
- 12  **DNA types**
 - ▶ Unique-sequence
 - ▶ Encoding
 - ▶ Unknown
 - ▶ Moderately repetitive
 - ▶ ~ 150-300bp repeated thousands of times
 - ▶ rRNA
 - ▶ tRNA
 - ▶ unknown
 - ▶ Highly repetitive
 - ▶ < 10bp repeated hundreds of thousands to millions of times
 - ▶ Centromeres, telomeres
 - ▶ No known function
- 13  **Transposable elements**
 - ▶ Barbra McClintock
 - ▶ Late 1948
 - ▶ Not recognized or understood
 - ▶ "I don't understand one word she said, abut if she says it is so, it must be so!" (Alfred Sturtevant)
 - ▶ 1983 Nobel Prize
 - ▶
 - ▶
 - ▶
 - ▶
 - ▶
 - ▶
 - ▶
 - ▶

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- ▶
- ▶ ~45% human DNA
- ▶
- 14 ▶ Common characteristics
 - ▶ Flanking direct repeats
 - ▶ ~3-12bp
 - ▶ Both sides & not part of TE
 - ▶ Consistent for each transposon type
 - ▶ Terminal inverted repeats
 - ▶ ~9-40bp
 - ▶ Recognized by transposition enzymes
- ▶
- 15 ▶ **Transposition**
 - ▶ Staggered breaks in target
 - ▶
 - ▶ Transposable element joined to target
 - ▶
 - ▶ DNA replicated at single strand gaps
 - ▶
- 16 ▶ DNA transposons (class I)
 - ▶ Replicative
 - ▶ Nonreplicative
- ▶ RNA transposons (class II)
 - ▶ retrotransposons
 - ▶ Reverse transcriptase
- ▶
- 17 ▶ **Effects**
 - ▶ Induce mutations
 - ▶ Inactivate
 - ▶ Activate
 - ▶ Antibiotic resistance
 - ▶ Insecticide resistance
 - ▶ Change phenotype
- ▶
- 18 ▶ **Evolutionary significance**
 - ▶ Cellular function hypothesis
 - ▶ Control expression or development
 - ▶ Genetic-variation hypothesis
 - ▶ Adapt to environmental change
 - ▶ Mechanisms to prevent transposition
 - ▶ Selfish-DNA hypothesis
 - ▶ No benefits
 - ▶
 - ▶ Not mutually exclusive

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