

1  **Chapter 14**

RNA Molecules & Processing

2  **14.1 Gene Structure**

- ▶ Colinear
 - ▶ Bacteria & viruses
 - ▶
 - ▶
- ▶ Eukaryotic
 - ▶ More DNA than required
 - ▶ Large RNA in nucleus not in cytoplasm
 - ▶ Hybridization experiments

3 

- ▶ Exons
 - ▶ Coding regions
- ▶ Introns
 - ▶ "Intervening sequences"
 - ▶ Noncoding regions
 - ▶ Size & # related to increasing complexity
 - ▶ Average human gene
 - ▶ 8-9 introns
- ▶ Splicing
 - ▶ Occurs after transcription
 - ▶ Removes introns & joins exons

4 

- ▶ Types of introns
 - ▶ Group I
 - ▶ Found in rRNA
 - ▶ Self-splicing
 - ▶ Group II
 - ▶ Found in protein encoding genes
 - Mitochondria & chloroplasts
 - ▶ Self-splicing
 - ▶ Nuclear pre-mRNA introns
 - ▶ Found in protein encoding genes
 - Nucleus
 - ▶ Not self-splicing
 - Requires snRNA's & proteins
 - ▶ Transfer RNA introns
 - ▶ Found in tRNA
 - ▶ Requires enzymes

5  **Messenger RNA**

- ▶ Transcription → pre-mRNA → mature mRNA
- ▶
- ▶ Codon
 - ▶ Set of 3 mRNA nucleotides which specifies an amino acid
- ▶

6 

- ▶ 3 regions of mRNA
 - ▶ 5' untranslated region (5'UTR) leader
 - ▶ Bacteria – Shine-Dalgarno sequence
 - Ribosome binding site
 - ▶ Eukaryotic
 - Modified 5' end of mRNA
 - ▶ Protein coding region
 - ▶ Start codon – stop codon
 - ▶ 3' untranslated region (3'UTR) trailer
 - ▶ Affects stability of mRNA
 - ▶ Affects translation of coding sequence

7 

- ▶ Bacterial cells
 - ▶ Simultaneous transcription & translation
- ▶ Eukaryotic cells
 - ▶ mRNA modification
 - ▶ 5'
 - ▶ 3'
 - ▶ Coding region

8 

- ▶ 5' Cap
 - ▶ Enzymes associate with RNA polymerase II
 - ▶ Nucleotide addition
 - ▶ Methylation
 - Addition of CH₃ groups
- ▶ Functions
 - ▶ Initiation of translation
 - ▶ Cap-binding proteins
 - Ribosome
 - ▶ Stability
 - ▶ Removal of introns

9 

- ▶ 3' Poly(A) Tail
 - ▶ 50-250 nucleotides
 - ▶ Consensus sequence
 - ▶ Upstream
 - AAUAAA
 - ▶ Downstream
 - uracil rich region
 - ▶ Polyadenylation
 - ▶ Function
 - ▶ Stability
 - ▶ Ribosome attachment

10 

- ▶ RNA Splicing
 - ▶ Consensus sequences
 - ▶ GU AG

- ▶ 5' splice site
 - ▶ 3' splice site
 - ▶ Branch point
 - Adenine
 - 18-40 nucleotides from 3' splice site
 - ▶ Spliceosome
 - ▶ 5 snRNA molecules & ~ 300 proteins
- ▶
- 11
- ▶ Splicing process
 - ▶ cut pre-mRNA at 5' splice site
 - ▶ 5' end attaches to branch point
 - ▶ Lariat formation
 - ▶ Cut at 3' splice site
 - ▶ Attachment of 3' of first exon to 5' of next exon
 - ▶ Branch point bond broken to release lariat
 - ▶ Rapidly degraded
 - ▶ Mature mRNA exported to cytoplasm
 - ▶
 - ▶ Transcription and splicing at same sites in nucleus
 - ▶
 - ▶
- 12
- ▶ Self-splicing introns
 - ▶ Group I and Group II
 - ▶ Secondary structures within RNA
- 13
- ▶ alternative processing pathways
 - ▶ >1 mRNA from same DNA sequence
 - ▶ Alternative splicing
 - ▶ Same pre-mRNA with different splicing pattern
 - ▶ Multiple 3' cleavage sites
 - ▶ Several potential sites for cleavage and polyadenylation
 - ▶ Both
- 14
- ▶ RNA Editing
 - ▶ Modifies sequence from the DNA template
 - ▶ Insertions
 - ▶ Deletions
 - ▶ Conversions
 - ▶
 - ▶ Guide RNA's (gRNAs)
 - ▶ Paring
 - ▶ Modification
 - ▶ Enzymes
 - ▶
- 15
- ▶ Transfer RNA
 - ▶ Anti-codon
 - ▶ Amino acid attachment (CCA)

16 

- ▶ Ribosome
 - ▶ Small subunit
 - ▶ Characterized by size
 - ▶ Structural
 - ▶ Large subunit
 - ▶ Characterized by size
 - ▶ Structural
 - ▶ Ribosomal RNA
 - ▶ Catalytic
 - ▶