Transcription

Synthesizing RNA from DNA

Agenda

- Comparison of DNA and RNA
- What is transcription?
- Short video
- Activity (Protein Synthesis from DNA)

DNA vs RNA

DNA	RNA

DNA vs RNA

DNA	RNA
Deoxyribose nucleic acid	Ribonucleic acid

DNA vs RNA

DNA	RNA
Deoxyribose nucleic acid	Ribonucleic acid
Adenine, thymine, guanine, cytosine	Adenine, uracil, guanine, cytosine

DNA vs RNA

DNA	RNA
Deoxyribose nucleic acid	Ribonucleic acid
Adenine, thymine, guanine, cytosine	Adenine, uracil, guanine, cytosine
Double stranded	Single stranded

DNA vs RNA

DNA	RNA
Deoxyribose nucleic acid	Ribonucleic acid
Adenine, thymine, guanine, cytosine	Adenine, uracil, guanine, cytosine
Double stranded	Single stranded
Deoxyribose sugar	Ribose sugar

Transcription

Objective:

accurately produce a copy of a small section of genomic DNA

- 3 steps:
  - Initiation
  - Elongation
  - Termination

Two strands of DNA

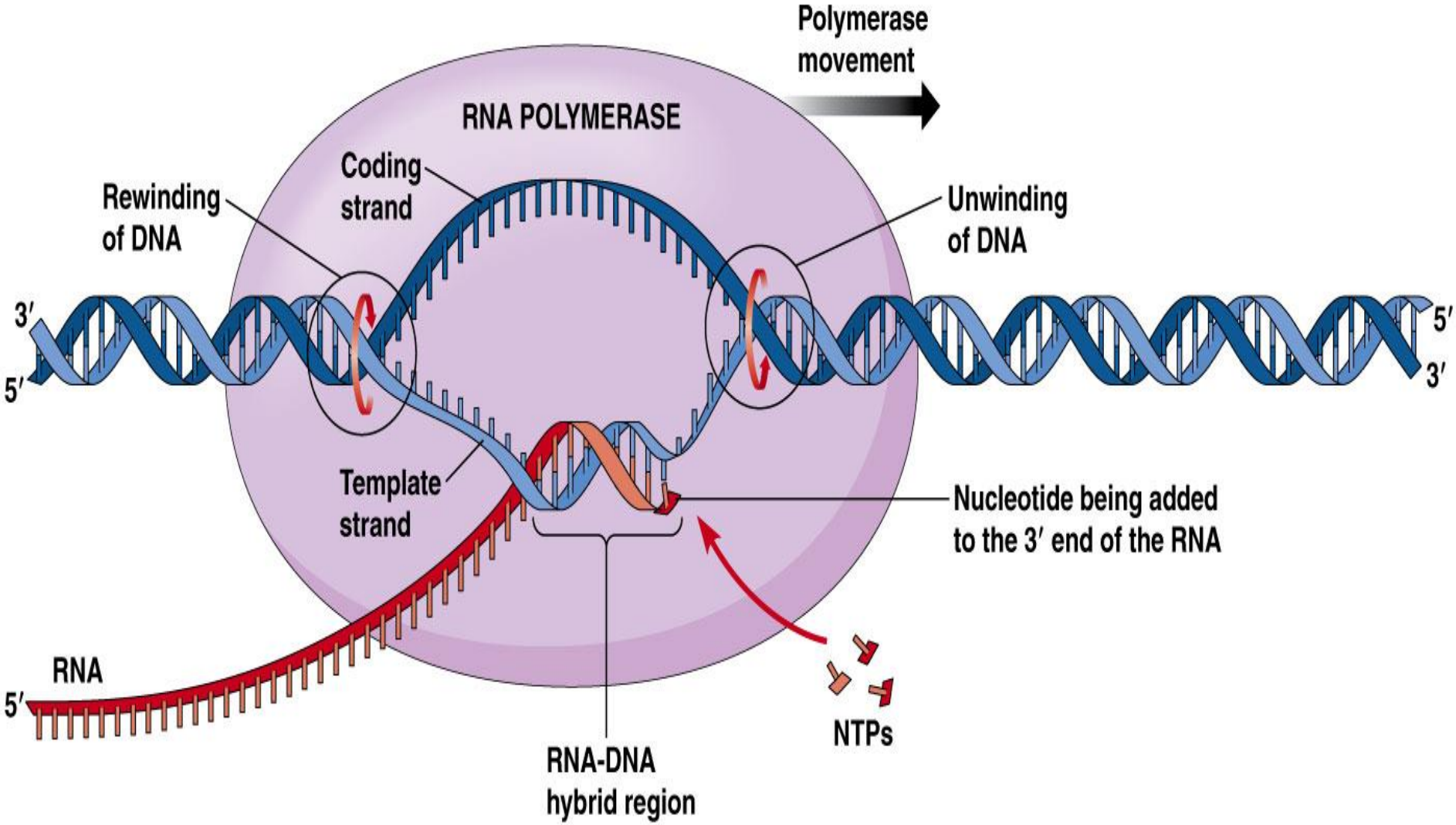
- Only one strand is transcribed into mRNA
- The transcribed strand is called the antisense strand or template strand
- The non-transcribed strand is called the sense strand or the coding strand
- The sense strand has the same nucleotide sequence as the product mRNA (with uracil instead of thymine)

Initiation

- RNA polymerase binds to promoter regions on DNA
- Promoter regions are specifically positioned nucleotide sequences that indicate where the RNA polymerase should bind to initiate transcription
- Once the RNA polymerase binds to the DNA, it unwinds and unzips a section of the double helix

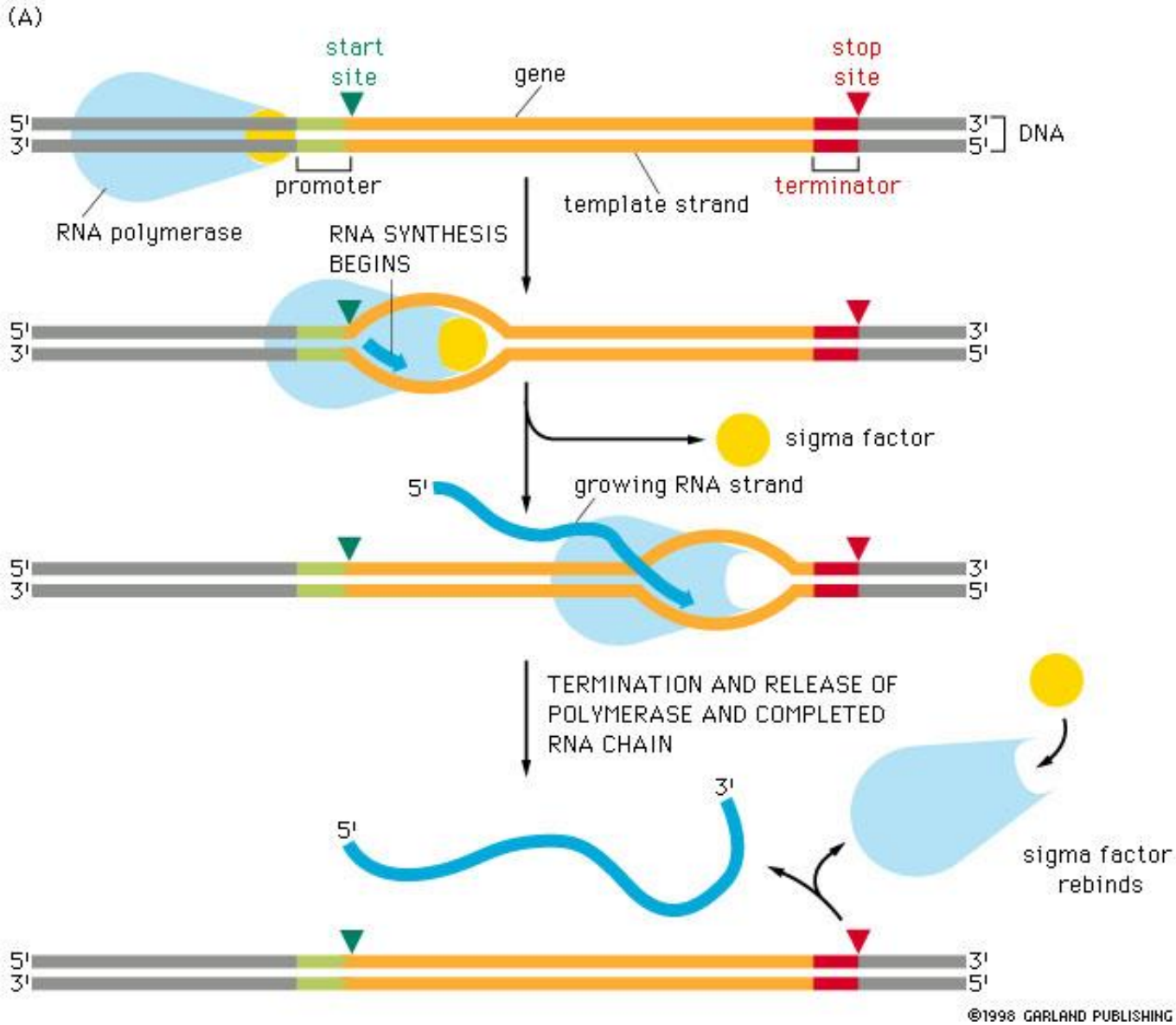
Elongation

- The RNA polymerase moves along the DNA strand and synthesizes a complimentary strand of mRNA in the 5’ to 3 ‘ direction.
- Remember that Thymine is replaced with Uracil
- As soon as the RNA polymerase moves away from the promoter region, a new RNA polymerase can attach and start forming another mRNA strand.



Termination

- Specific nucleotide sequences in the template DNA serve as a signal to stop transcription.
- The RNA polymerase complex detaches from the DNA strand
- The mRNA strand is released from the complex
- The DNA molecule reforms into a double helix


(A)
start site
gene
stop site
5'
3'
3'
5'
DNA
promoter
terminator
template strand
RNA polymerase
RNA SYNTHESIS BEGINS
sigma factor
growing RNA strand
TERMINATION AND RELEASE OF POLYMERASE AND COMPLETED RNA CHAIN
sigma factor rebinds
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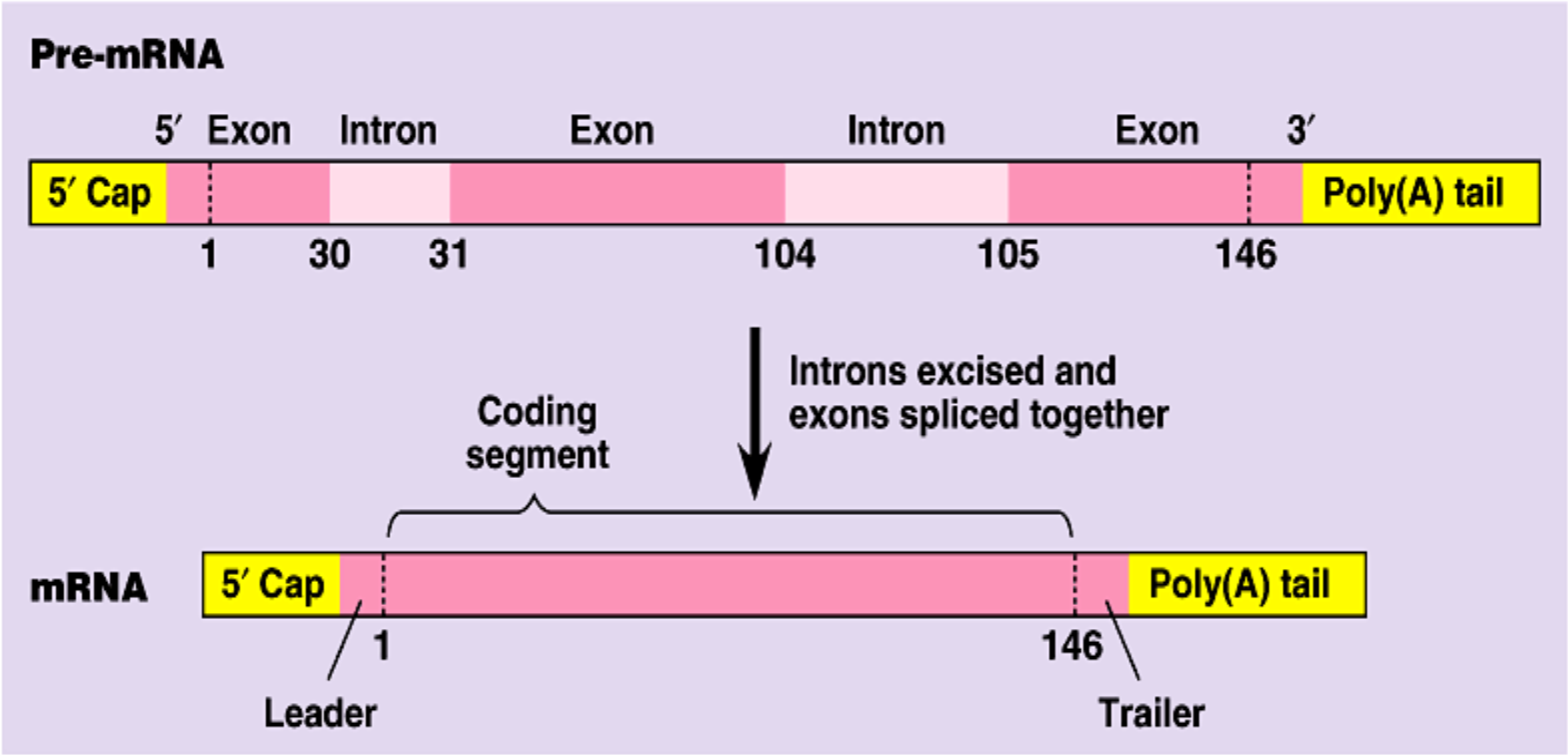
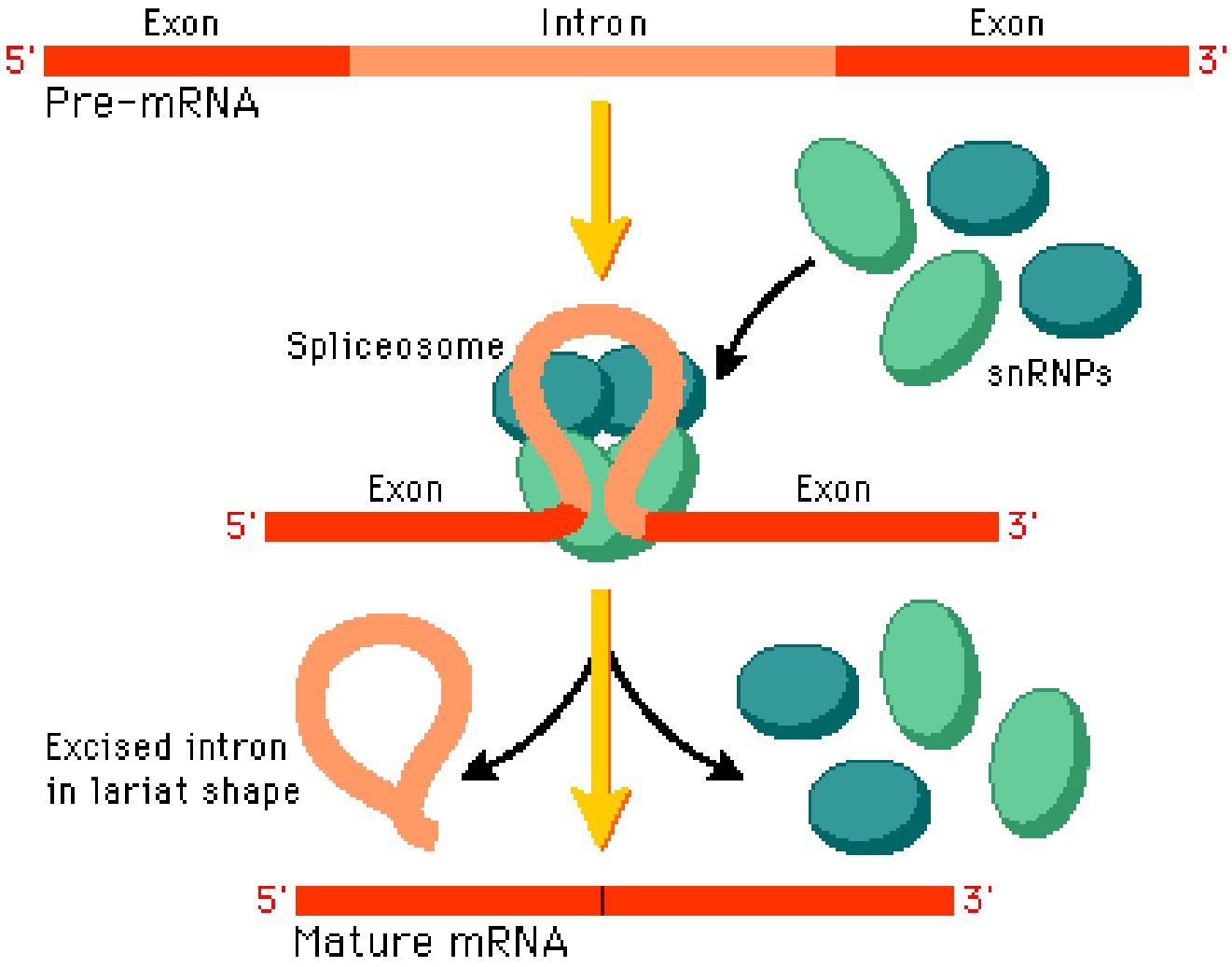
mRNA modifications in Eukaryotes

- Precursor mRNA must be converted into mature mRNA before it can be used in protein synthesis
- Addition of 5’ cap
- Addition of 3’ poly-A tail
- Splicing (removal of introns and joining exons)
  - In most cases, all exons of a gene are spliced together. Sometimes, alternative splicing will occur where only certain exons are spliced together. This allows one gene to code for more than one protein.




Exon
Intron
Exon
5'
3'
Pre-mRNA
Spliceosome
snRNPs
Exon
Exon
5'
3'
Excised intron
in lariat shape
5'
3'
Mature mRNA

Activity

- In groups of 3, convert the provided DNA sequence into an amino acid sequence. Then identify the corresponding hypothetical protein. Refer to the chart on page 248 for amino acid codons.
- ***Assume that the mRNA sequence has already been spliced.

Homework

- Read 6.2 and answer the following questions
- Pg. 254: 7, 9, 11, 12
- Pg. 256: 4, 5, 7, 13

Quiz on Wednesday, Feb 24 (6.1 & 6.2)