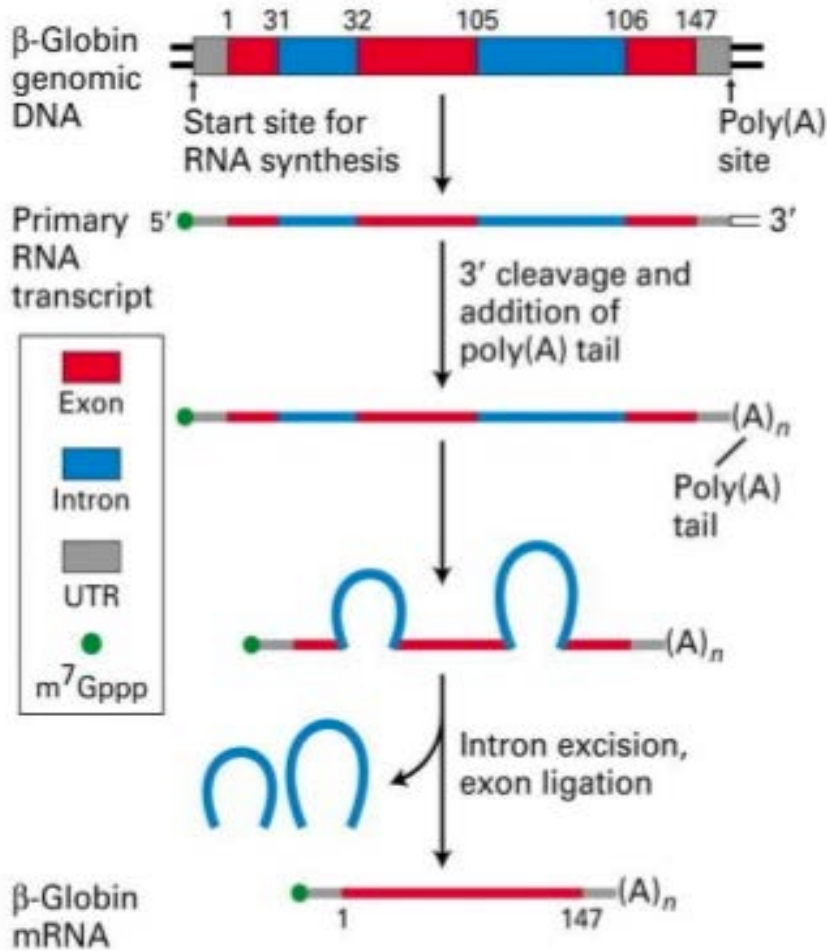


Summary slide:

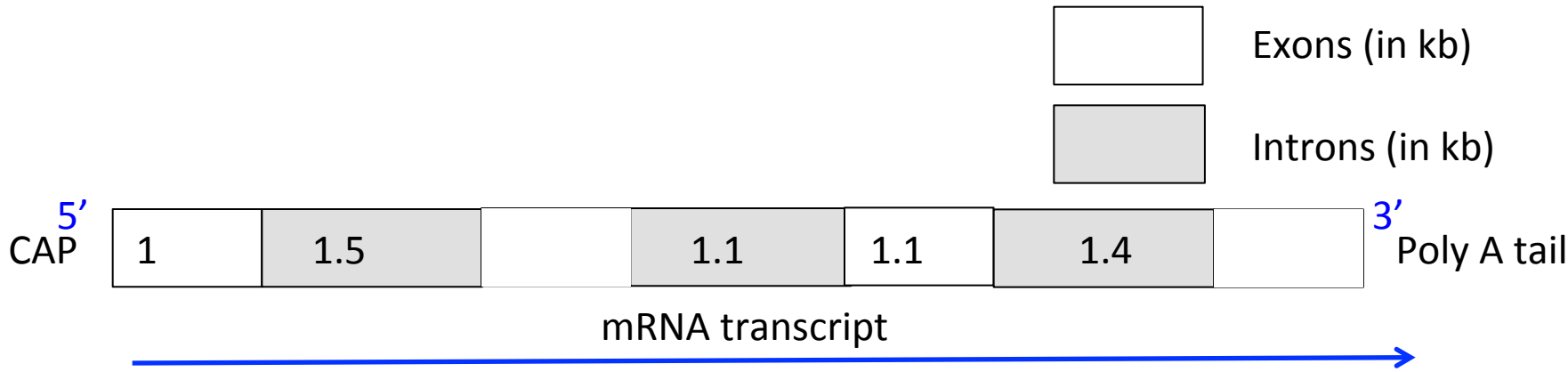
RNA processing: 5' & 3' modification and splicing of beta globin gene



- 5' Cap (adding 7 methyl guanoses) stabilizes mRNA, allows ribosome binding.
- 3' Poly A stabilizes mRNA and promotes its export to cytoplasm.
- Each intron has a 5' splice donor and a 3' splice acceptor site.
- Introns can be alternatively spliced out.

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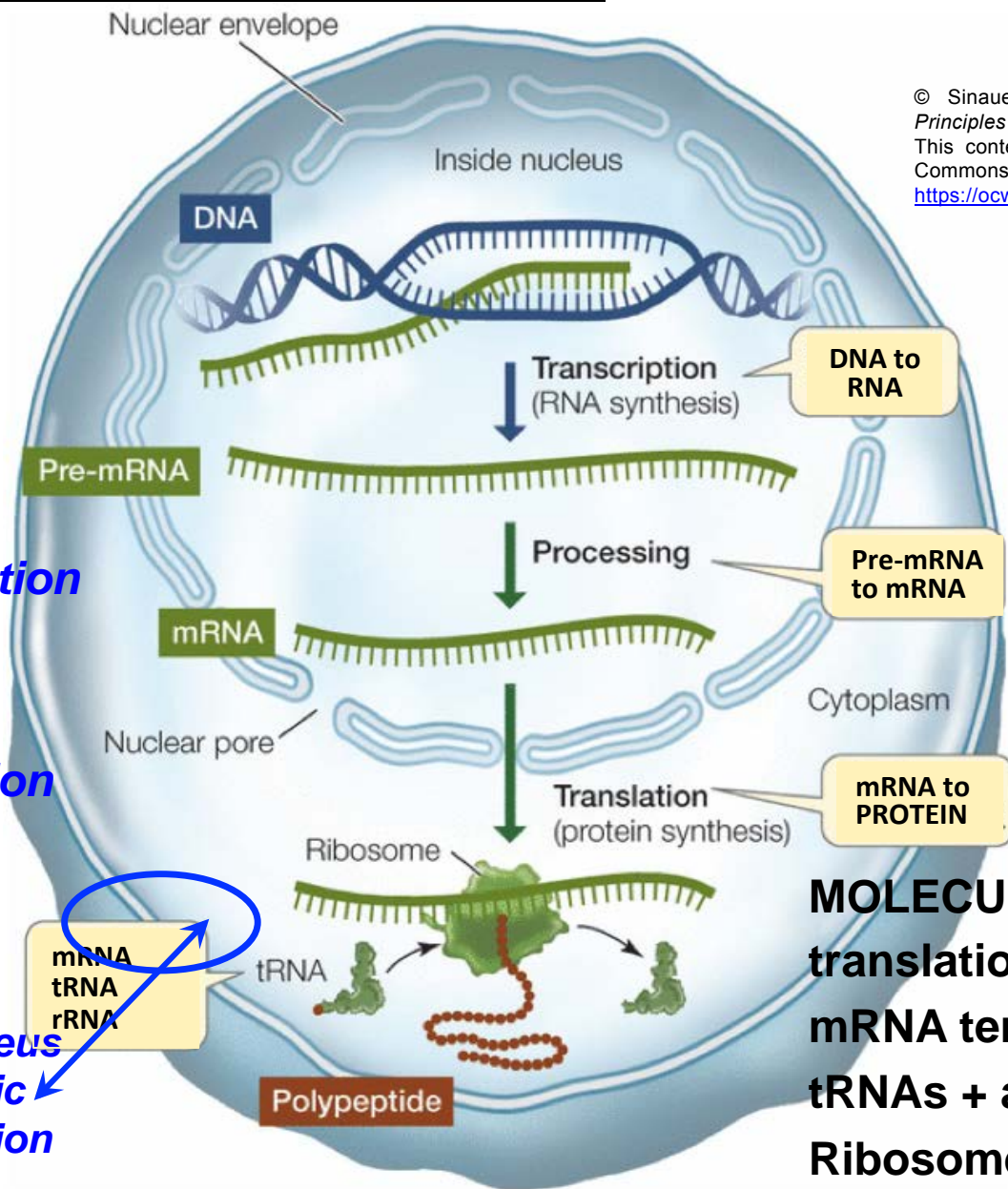
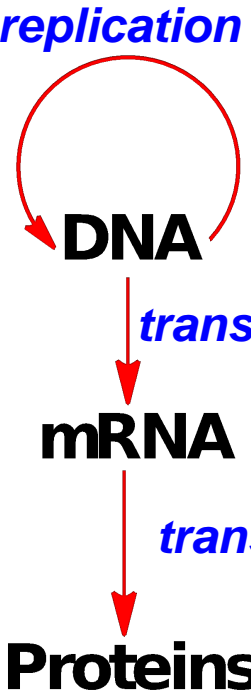
Schematic of an mRNA transcript



- Transcript shown is nascent or **spliced**. Circle one.
- Label the **5'** and **3'** ends of the transcript.
- Show the direction in which the transcript is made using an arrow.
- How **many mature mRNA transcripts** can result from this transcript (Assume all introns are removed)?
4: (E1+E2+E3+E4), (E1+E4), (E1+E3+E4), (E1+E2+E4)
- Give the length (in kb) of each mature transcript.
4kb, 2kb 3kb, 2.9kb

Summary slide: From Gene to protein

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Mature mRNA leaves the nucleus of the eukaryotic cell for translation into protein!

- MOLECULAR PLAYERS in translation:**
- mRNA template (read 5' -> 3')
 - tRNAs + amino acids
 - Ribosomes (rRNA + protein)
 - Peptide chain (made N->C)

For the mature mRNA below...

5' CGGUCCCGGUAAUG / AAU / GUG / UGC / UGACCGAUC3'

Name a sequence that is a part of nascent but NOT mature mRNA?
(Think of what gets spliced out) *Introns*

Name a sequence that is a part of gene but NOT transcribed mRNA?
(Think of regulatory regions) *Promoters and/or enhancers*

Underline the corresponding 5'UTR.
(The 3'UTR is underlined. Think of the region prior to the start codon)

Box the open reading frame (ORF) & separate each codon by "/".
(Think of the region prior to the start and stop codon)

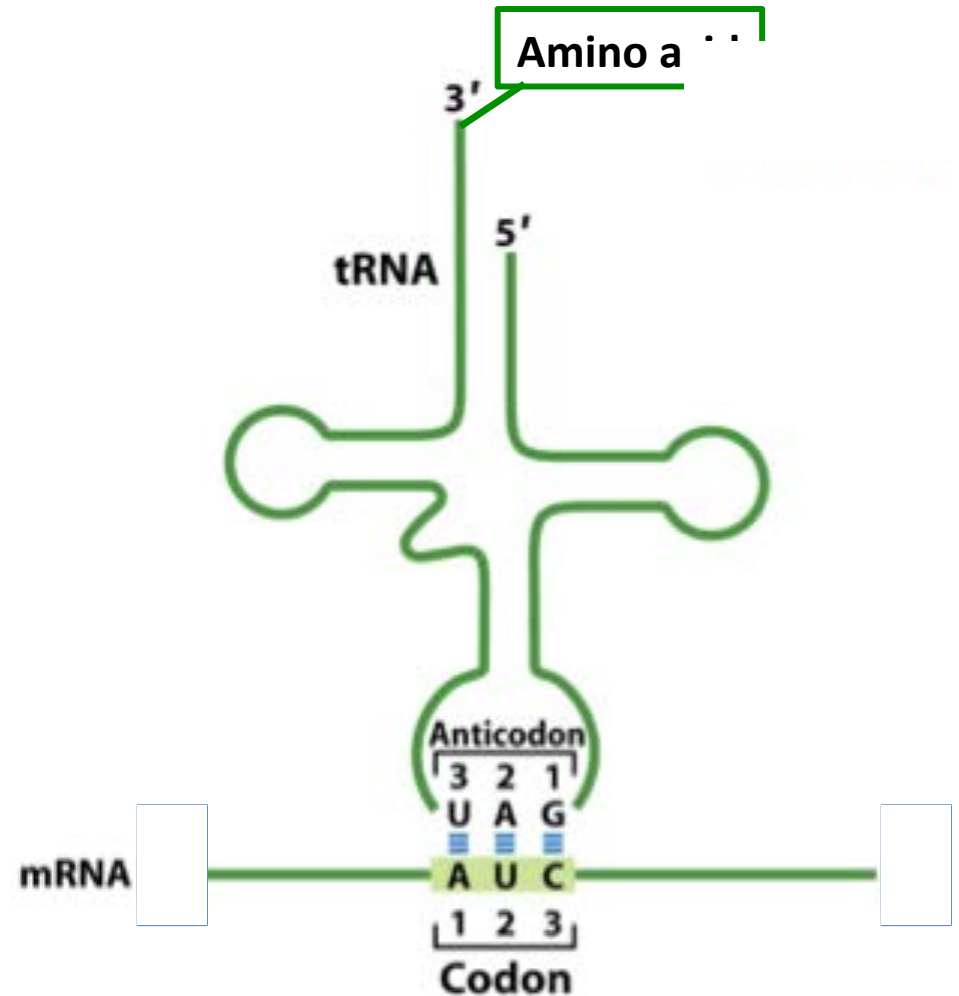
Write the corresponding protein (N → C; use the genetic code chart) *N-Met-Asn-Val-Cys-C*

tRNA and mRNA binding during translation

Label the 5' and 3' ends of mRNA in the drawing
(The binding is anti-parallel and complementary)

Which amino acid will this tRNA be charged with?
(Take a look at the codon chart)

Ile



For the prokaryotic gene below, and bottom strand as template

5 ' ACATGCATGTGTGCAAATAA 3 '

3 ' TGTACGTACACACGTTTATT 5 '

Write the corresponding RNA, indicating each codon

(RNA sequence = non-template strand, 5' to 3', codon = base triplets)

5 ' ACAUGC AUG UGU GCA AAU AA 3 '

Write the corresponding protein

(N → C; use the genetic code chart) *N-Met-His-Val-Cys-Lys-C*

Write the corresponding anti-codon sequence for 2nd amino acid.

(RNA sequence = non-template strand, 5' to 3', codon = base triplets)

5'-ACA-3'

The tRNA works as an adaptor molecule. Explain.

(Think what does tRNA bind to) *It binds to both mRNA and amino acids.*

It translates the information in mRNA to make the protein

For the prokaryotic gene below, and bottom strand as template

5 ' ACATGAAATTTGGGCTGTAA3 '
3 ' TGTACTTTTAAACCCGACATT5 '

Write the corresponding RNA and shade the ORF

5 ' ACAUGAAAUUUGGGCUGUAA3 '

Write the corresponding protein and label its N and C ends

N-Met-Lys-Phe-Gly-Leu-C

Write the corresponding anti-codon sequence for 1st amino acid.

5'-CAU-3'

DNA POINT MUTATIONS

WILD TYPE

DNA (coding/non-template)
(template)

5' ATG CCC GGG TTA GGG 3'
3' TAC GGG CCC AAT CCC 5'

Reading frame

mRNA

5' AUG CCC GGG UUA GGG 3'

Protein

N-Met Pro Gly Leu Gly-C

FRAME SHIFT mutation

DNA (coding)
(template)

5' ATG **CCC** GGG TTA GGG 3'
3' TAC **GGG** CCC AAT CCC 5'

delete

mRNA

5' AUG CCG GGU UAG GG... 3'

Protein

N-Met Pro Gly STOP -C

SILENT mutation codes for the SAME amino acid

A instead of C in mRNA



DNA (coding/non-template)	5' ATG CCA GGG TTA GGG 3'
(template)	3' TAC GGT CCC AAT CCC 5'
mRNA	5' AUG CCA GGG UUA GGG 3'
Protein	<i>N-Met Pro Gly Leu Gly-C</i>

MIS-SENSE mutation codes for a DIFFERENT amino acid

G instead of U in mRNA



DNA (coding)	5' ATG CCC GGG GTA GGG 3'
(template)	3' TAC GGG CCC CAT CCC 5'
mRNA	5' AUG CCC GGG GUA GGG 3'
Protein	<i>N-Met Pro Arg Val Gly-C</i>

If the gene sequence is mutated (red and underlined) and bottom strand is template

Wild-type
5' ATGAATGTGTGC.....3'
3' TACTTACACACG.....5'



Mutant
5' ATGAATGTGTGA.....3'
3' TACTTACACAGT.....5'

Write the new corresponding RNA, indicating each codon
(RNA sequence = non-template strand)

5-AUGAAUGUGUGA-3'

Write the new corresponding protein

N-Met-Asp-Val-C

Identify the type of point mutation

Non-sense

If the gene sequence is mutated (red), bottom strand as template

5 ' ATGAATGTGTGC.....3 '

3 ' TACTTACACACG.....5 '



5 ' ATGAATAGTGTGC.....3 '

3 ' TACTTATCACACG.....5 '

Write the new corresponding RNA, and indicate codons

5 ' AUGAAUAGUGUGC.....3 '

Write the new corresponding protein

N-Met-Asp-Ser-Val.....-C

Identify the type of point mutation

Missense

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