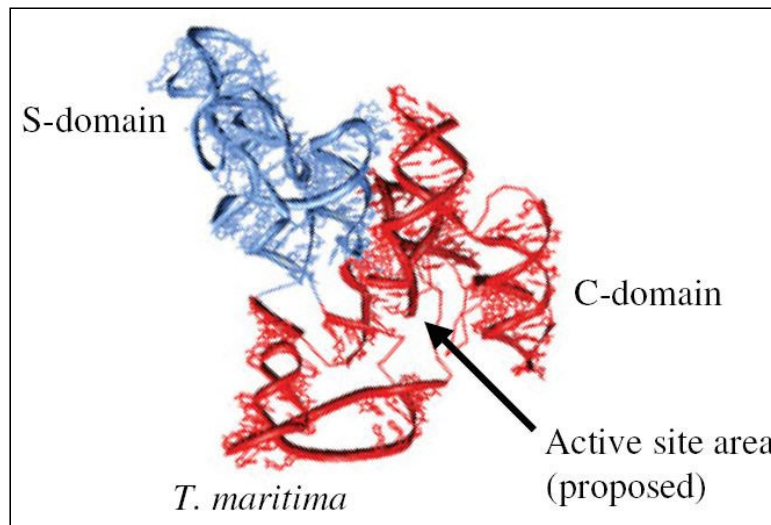


Zorenje RNA

Voet 3: poglavje 31.4

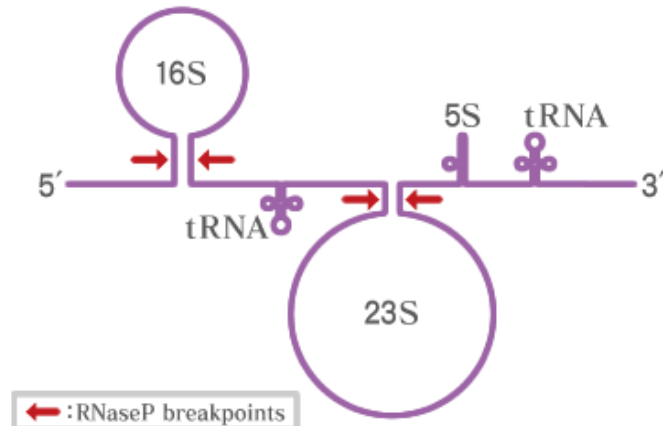
Stryer 5: poglavji 28.3 in 28.4

Krebs 3: poglavje 21



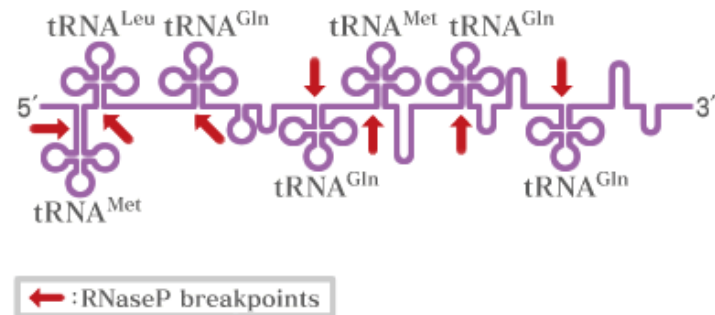
(A)

Cleavage of an RNA precursor into rRNA



(B)

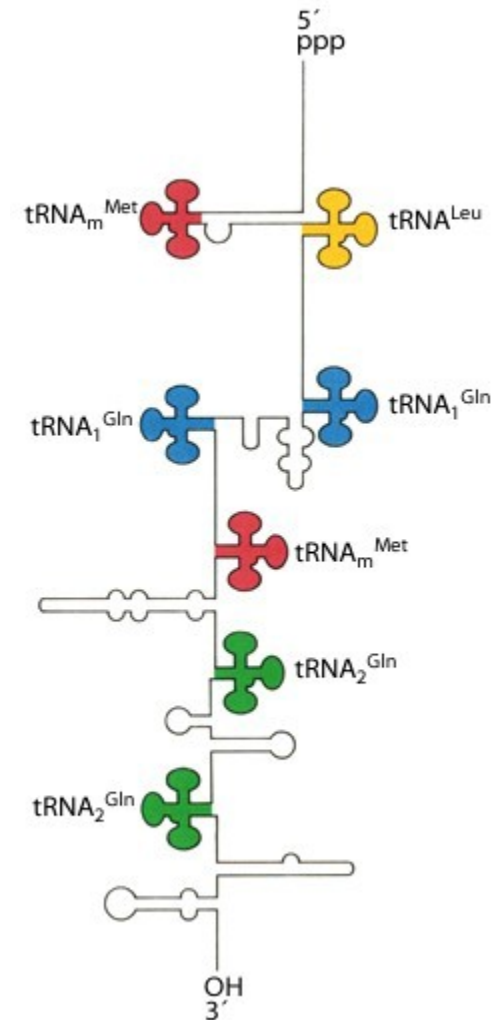
Cleavage of an RNA precursor into tRNA

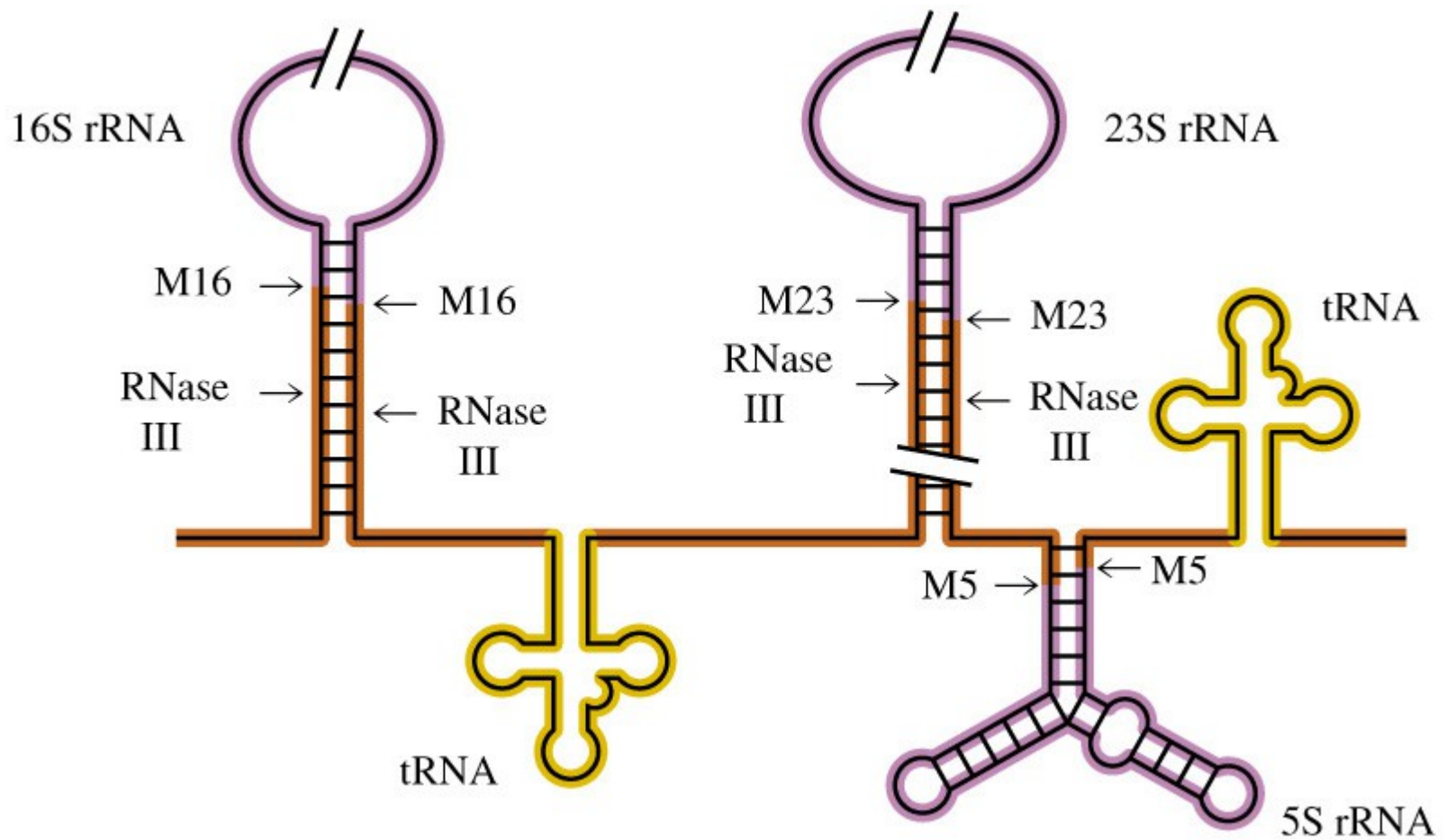


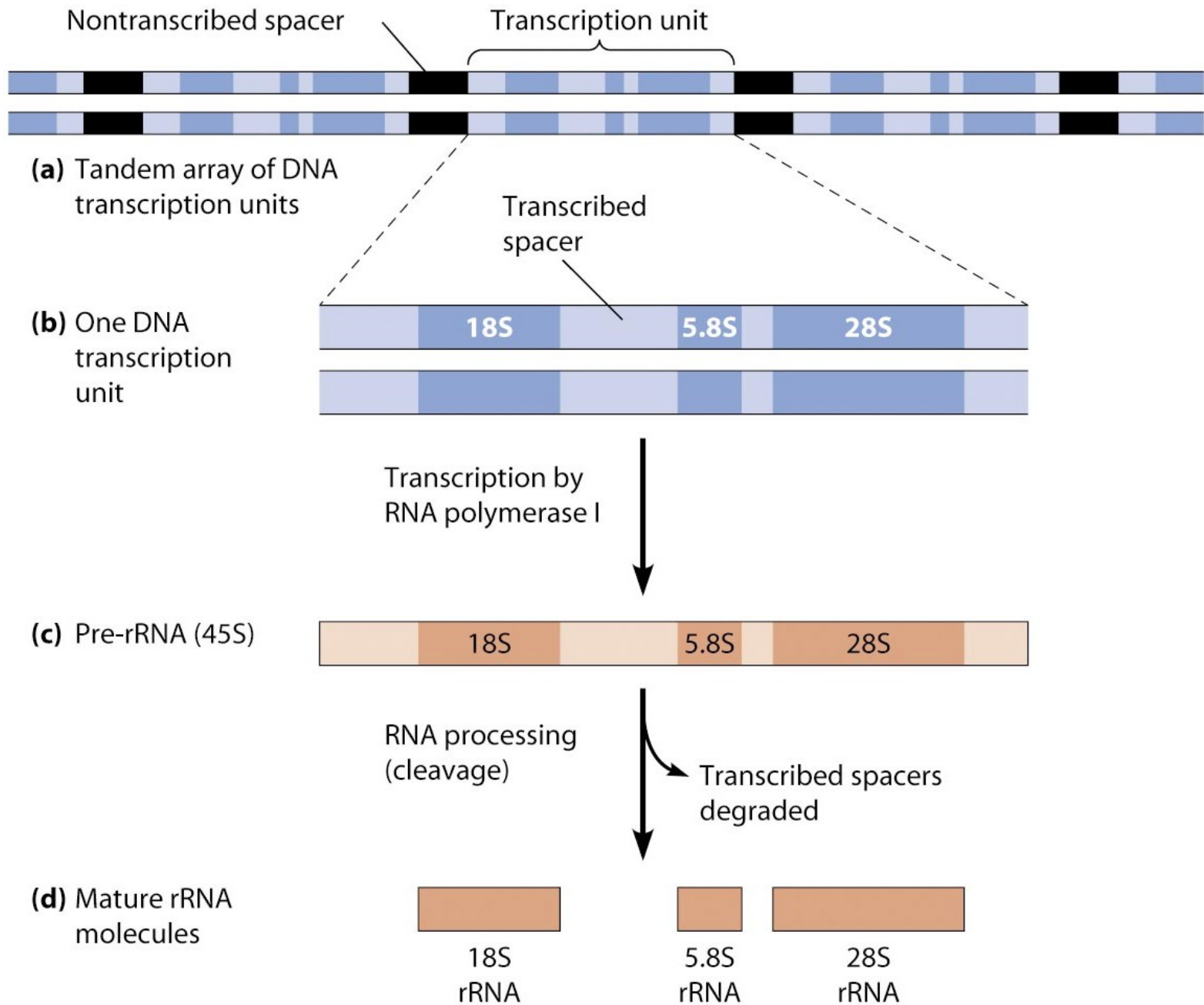
OPERON	tRNA GENES
rrnA	tRNA-Ile, tRNA-Ala
rrnB	tRNA-Glu
rrnC	tRNA-Glu, tRNA-Asp, tRNA-Trp
rrnD	tRNA-Ala, tRNA-Ile, tRNA-Thr
rrnE	tRNA-Glu
rrnG	tRNA-Glu
rrnH	tRNA-Ala, tRNA-Ile, tRNA-Asp

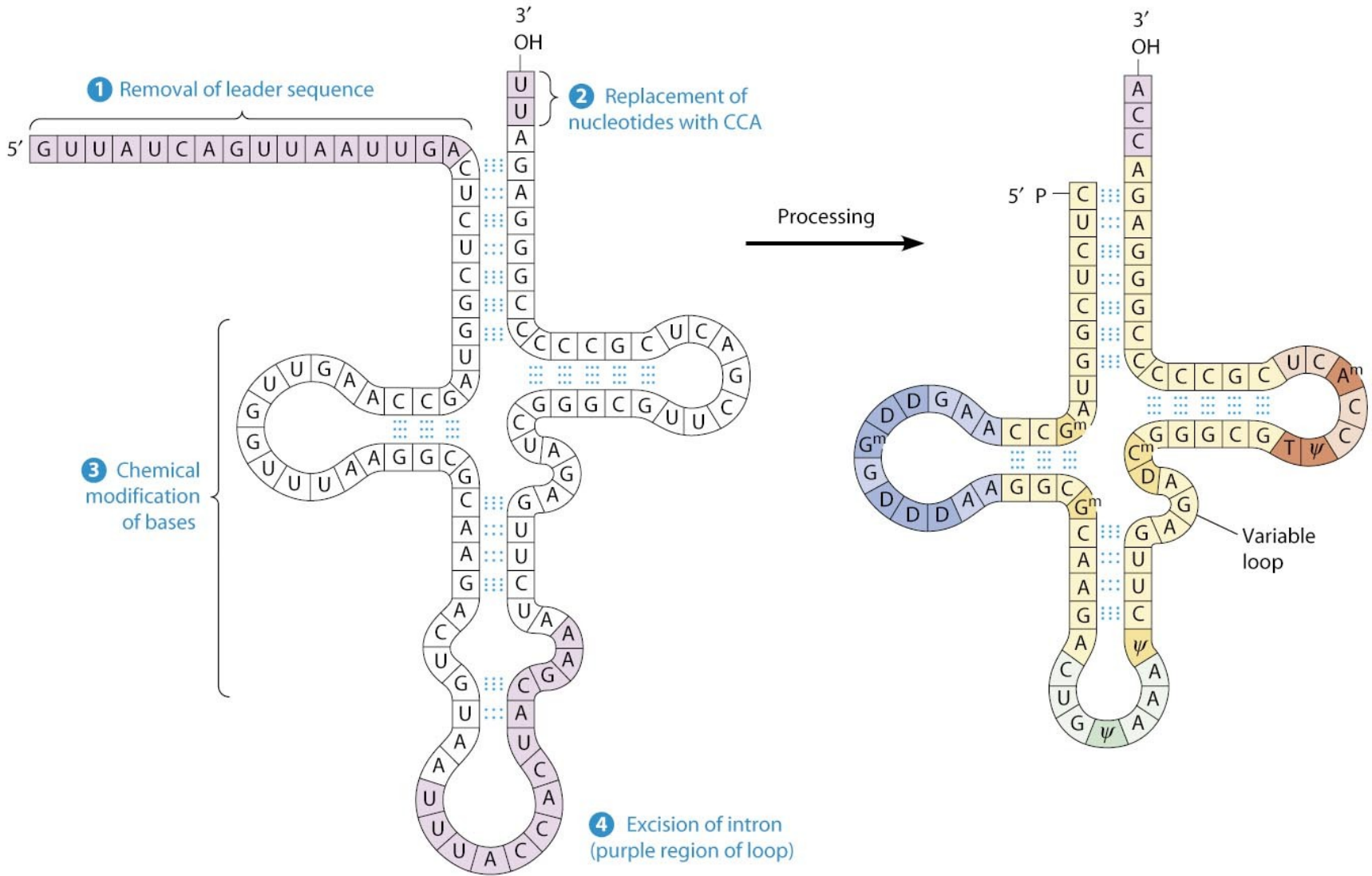
Pri *E. coli* je 7 operonov, ki zapisujejo za rRNA (tri velikosti)
+ za nekatere tRNA (zgoraj).

Dodatni operoni vsebujejo samo zapise za (po ve) tRNA (desno).





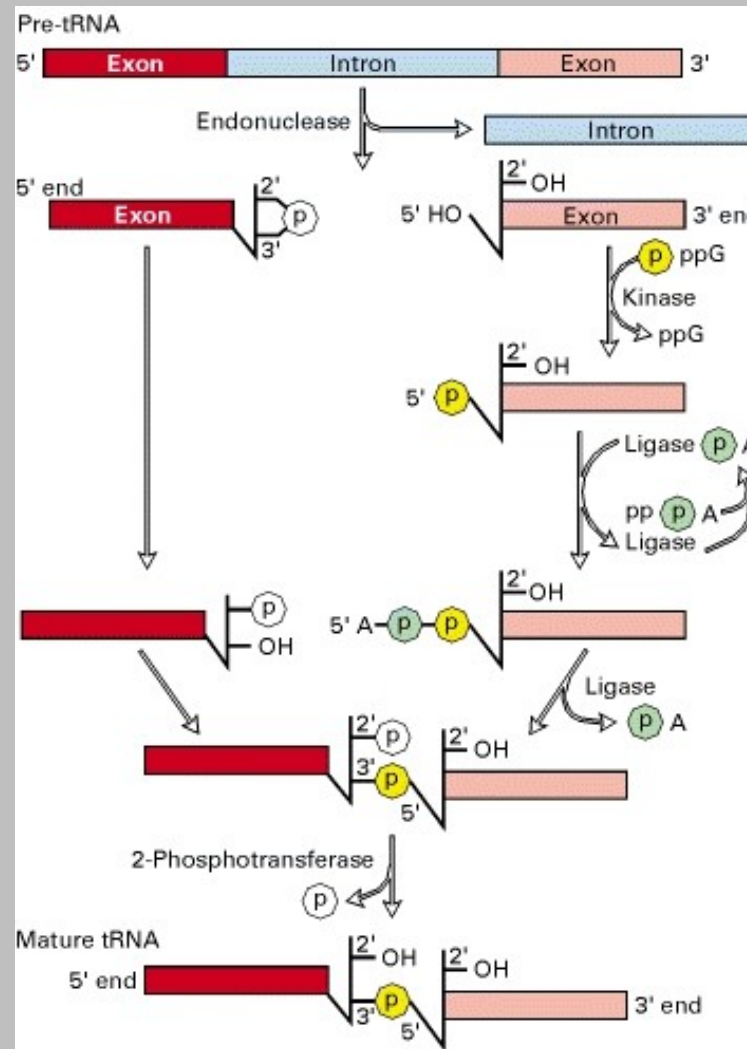


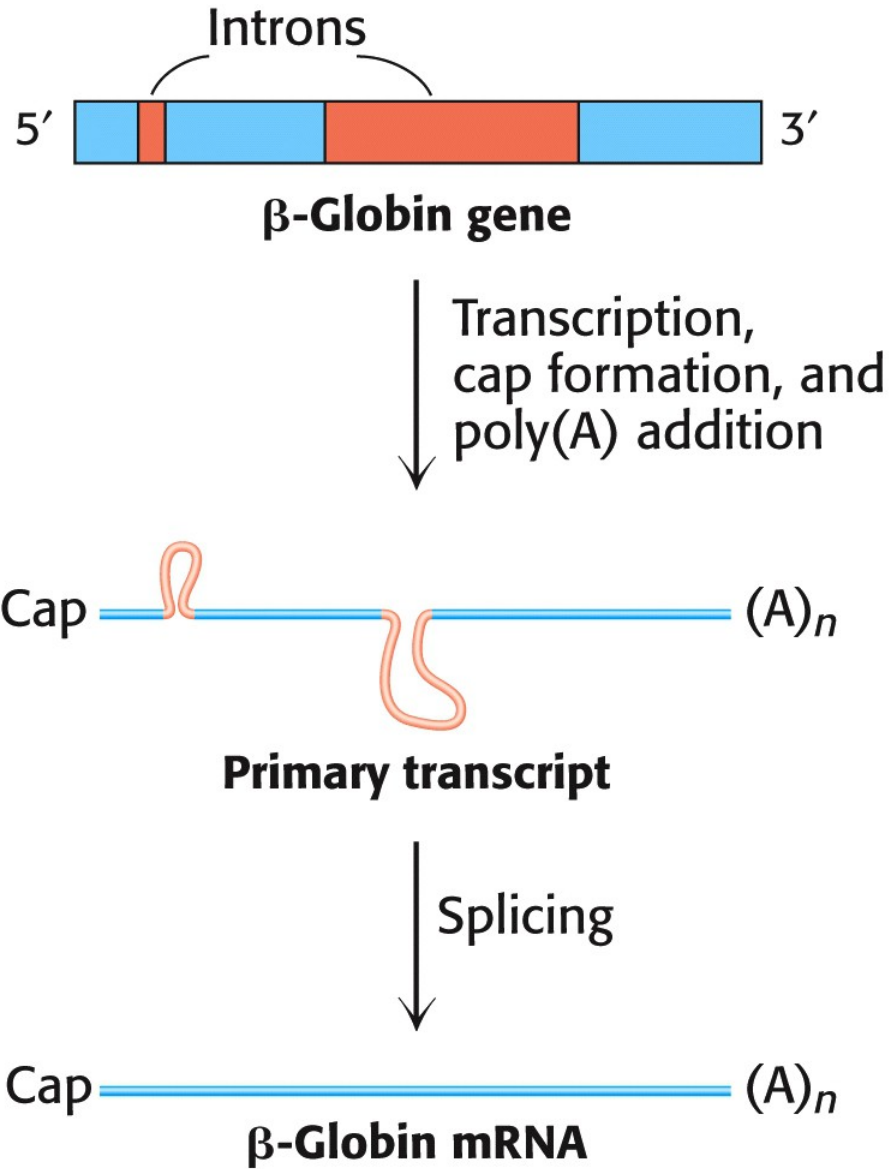


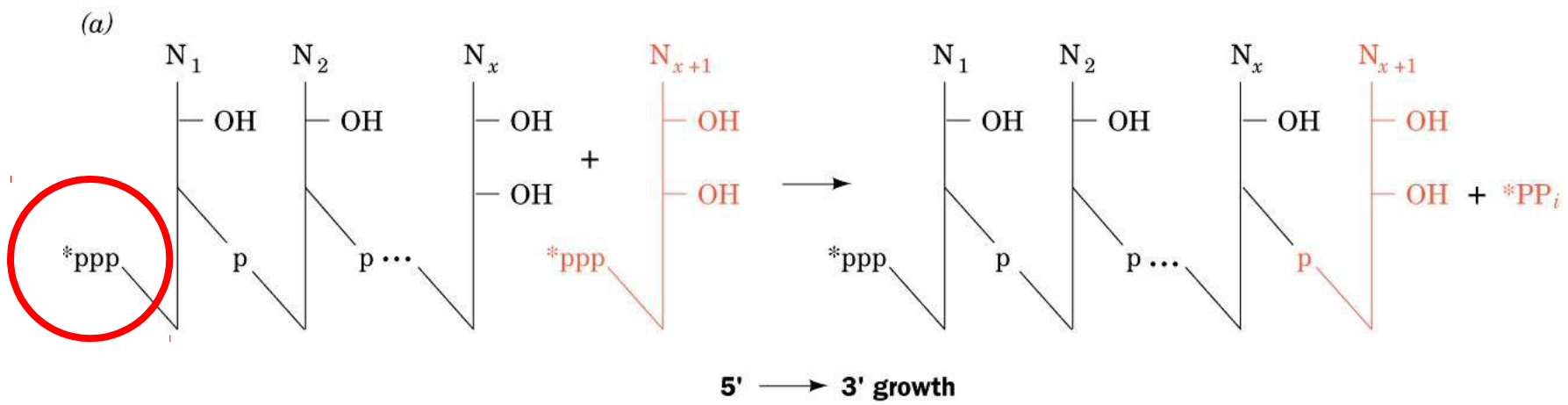
(a) Primary transcript (precursor) for yeast tyrosine tRNA

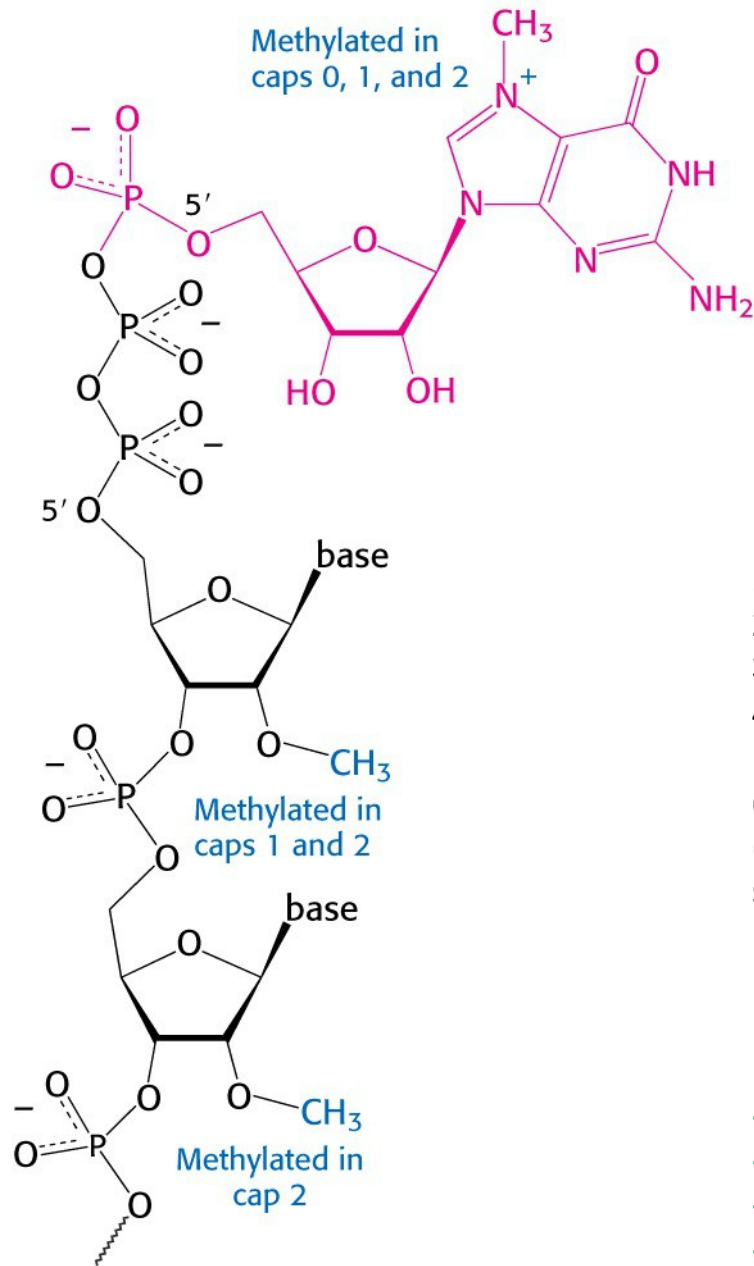
(b) Mature tRNA, secondary structure

Povezovanje delov tRNA po izrezu introna









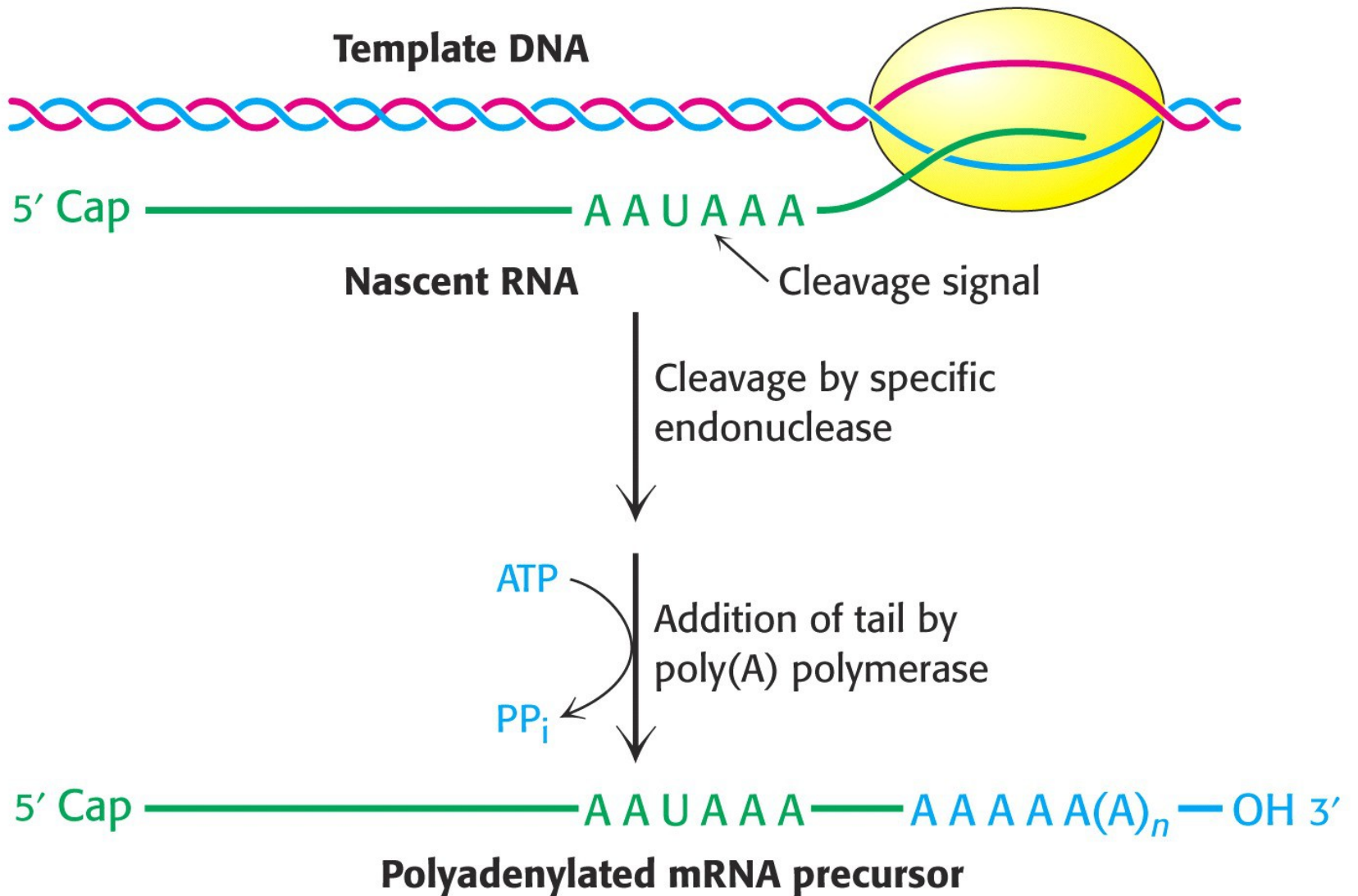
Postopek modifikacije 5'-konca:

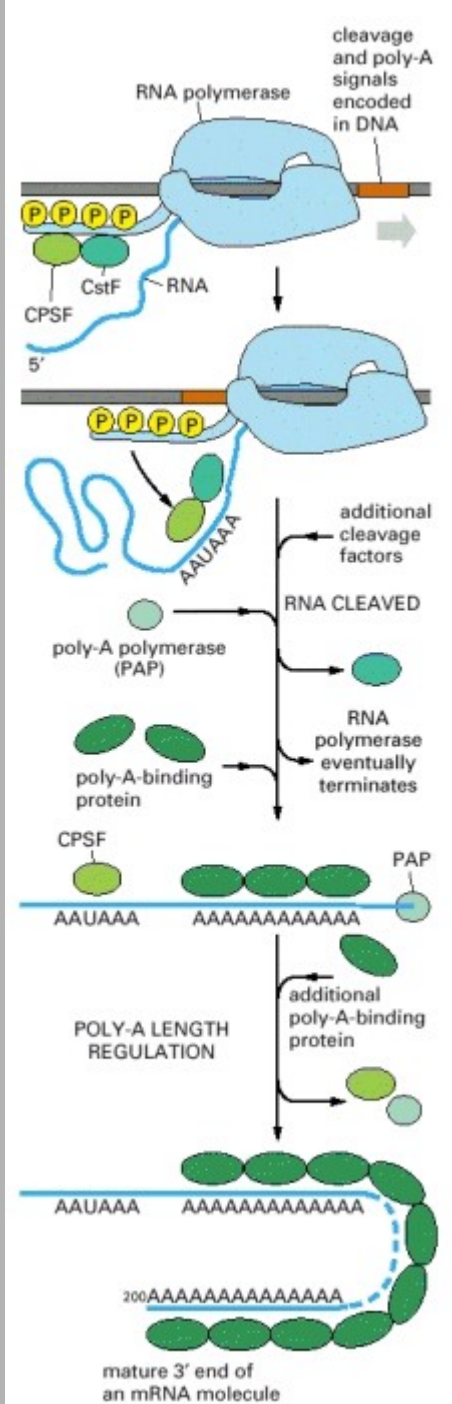
1. RNA terminalna transferaza odstrani končni fosfat
2. gvanililtransferaza doda GMP (iz GTP)
3. metiltransferaza doda Me na N7
4. poteče lahko še metilacija na A2 in včasih 3. baze

celotni encimski kompleks imenujemo tudi CEC (capping enzyme complex) – vezan je na RNA-pol II, sicer pa gvanililtransferazo imenujejo tudi CE

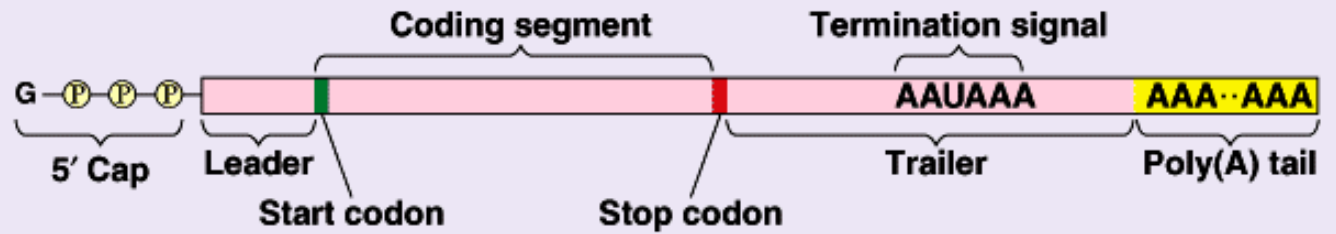
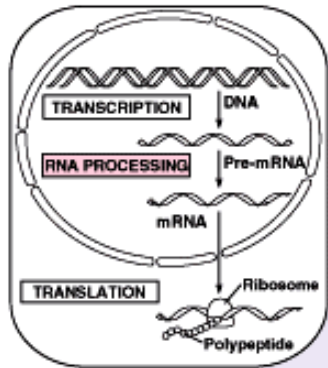
Funkcije:

- stabilnost
- izvoz iz jedra
- omogoča izrez 5'-introna
- pospešuje translacijo

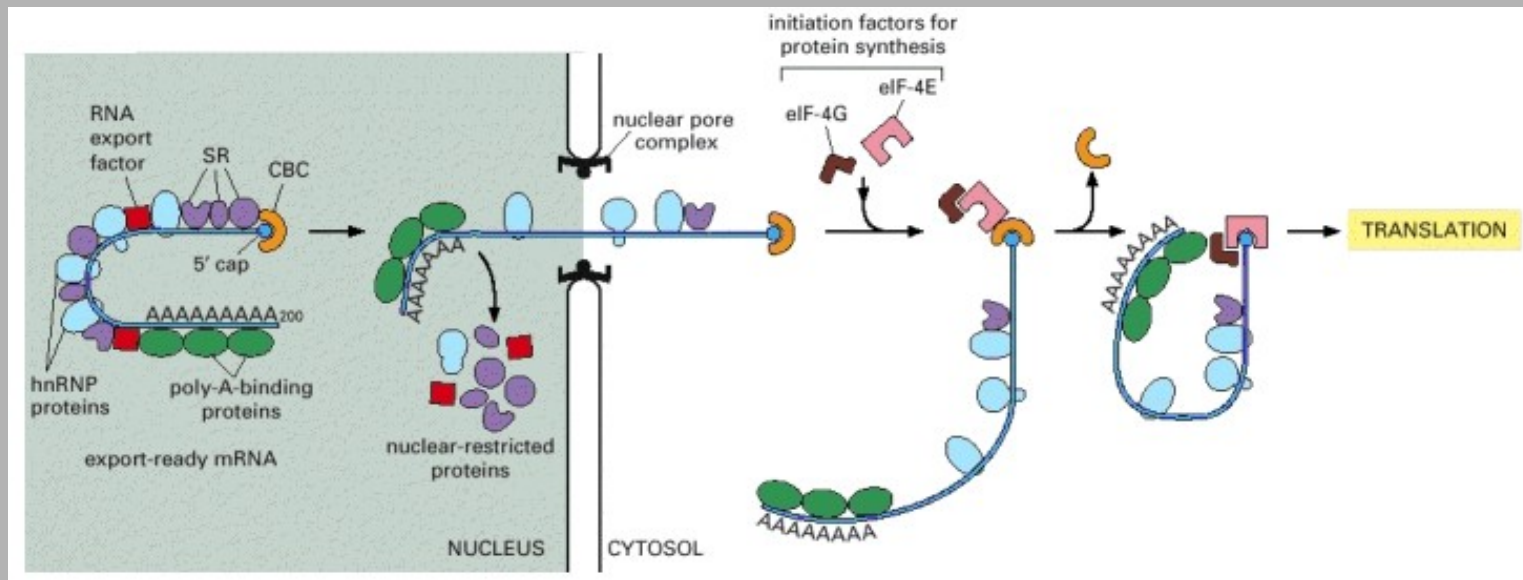




CPSF: cleavage and polyadenylation specificity factor
 CstF: cleavage stimulation factor F

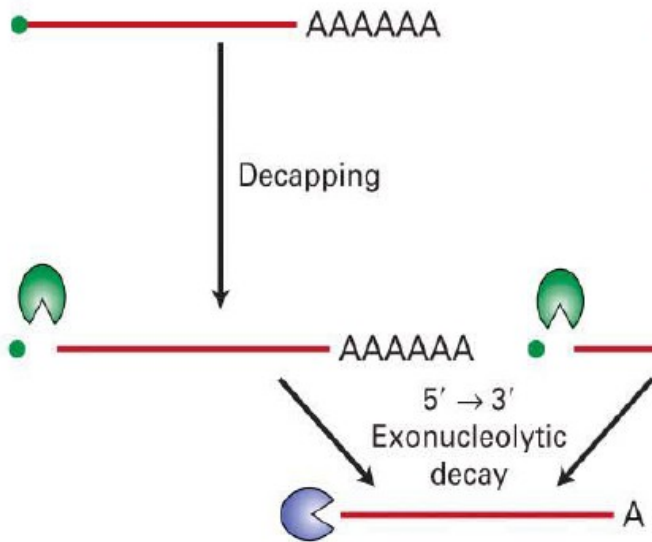


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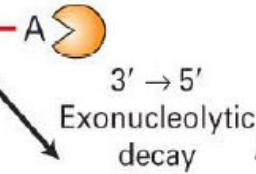
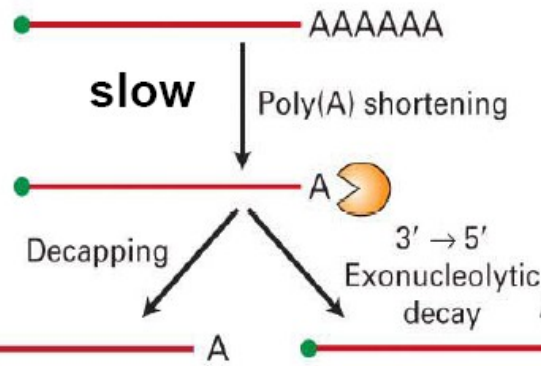


mRNA Degradation

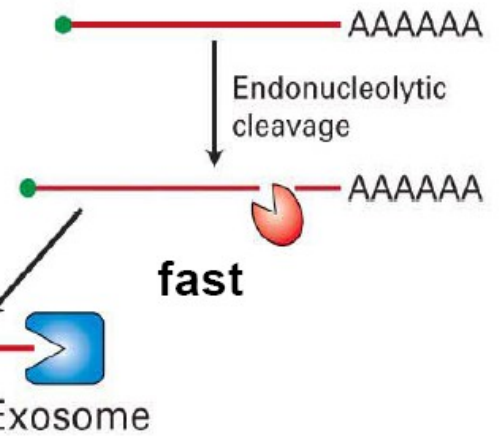
Decapping pathway (deadenylation-independent)



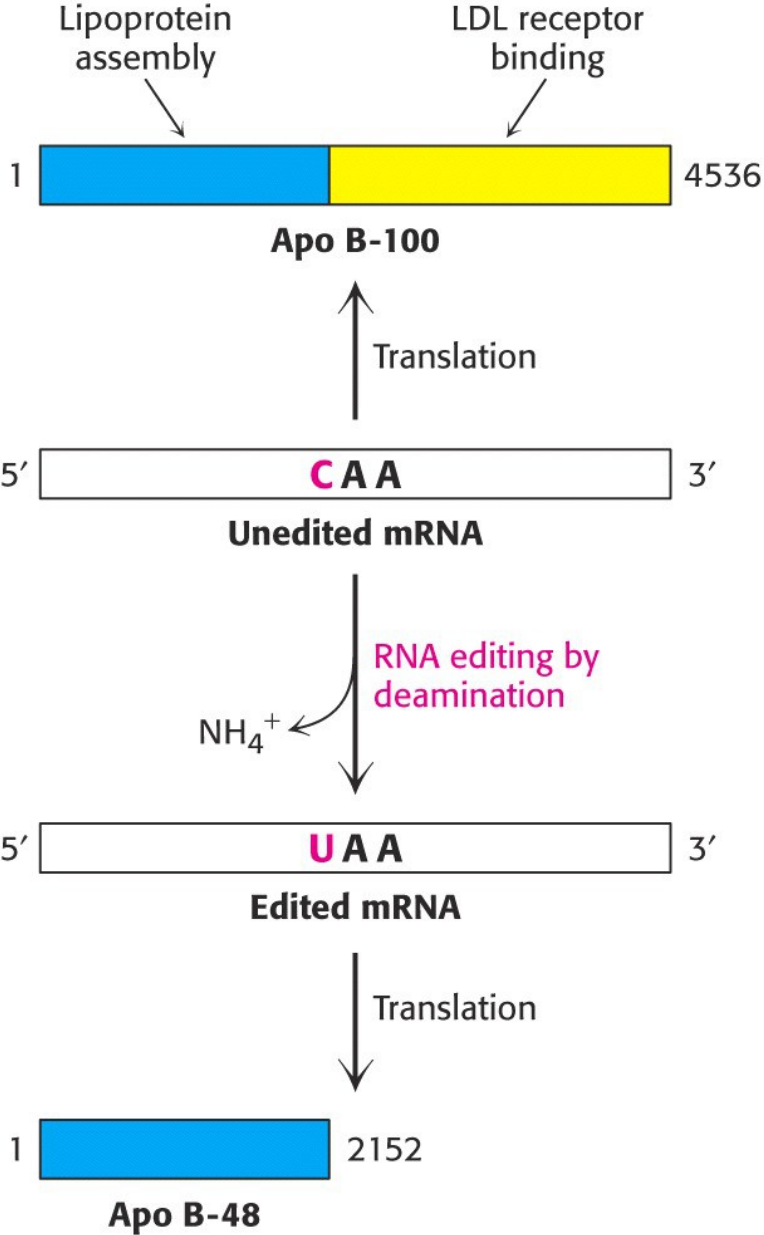
Deadenylation-dependent pathways



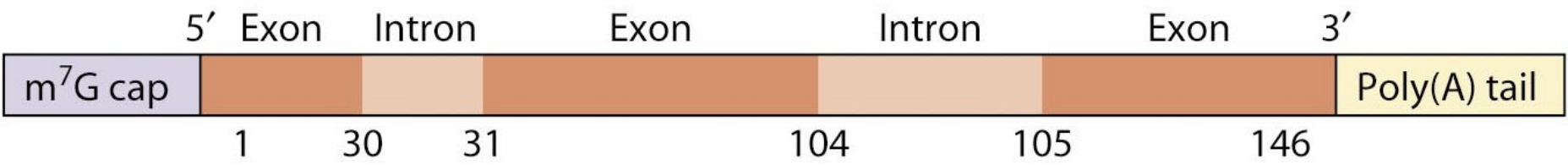
Endonucleolytic pathway



urejanje RNA



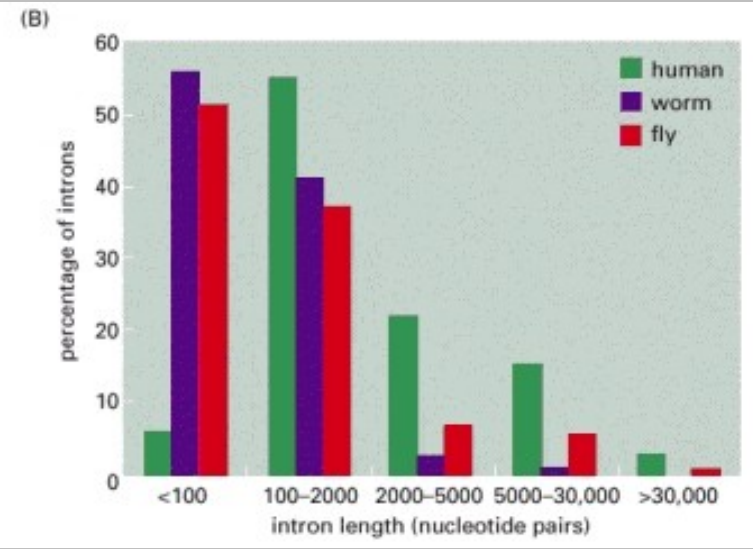
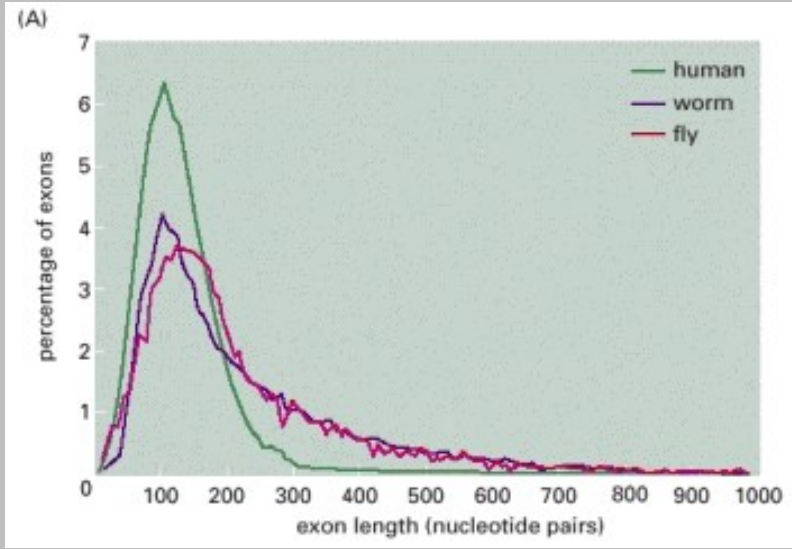
Primary transcript (pre-mRNA)



Introns excised and exons spliced together

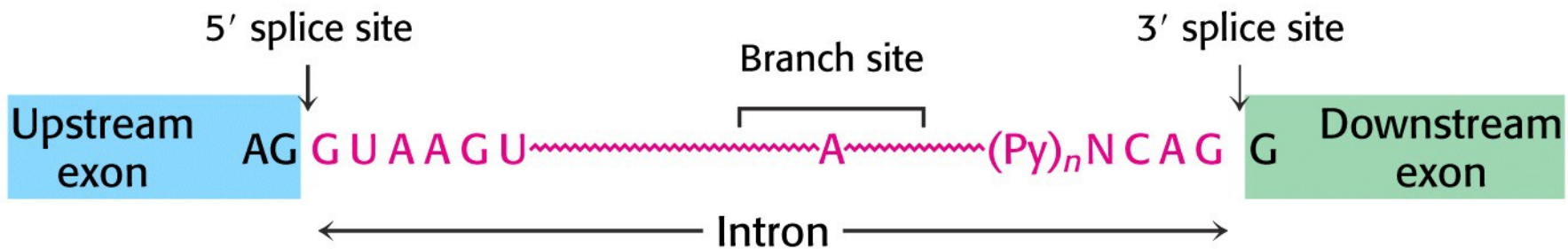
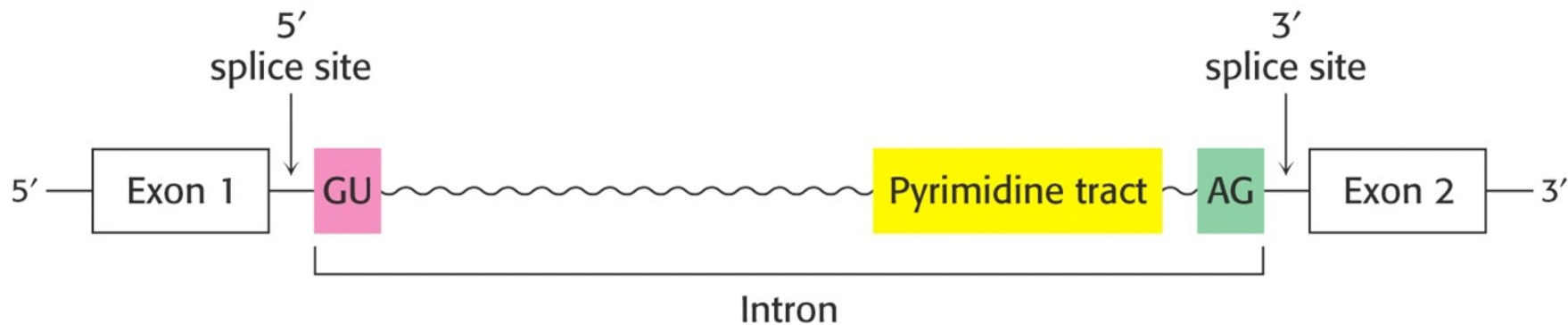
mRNA



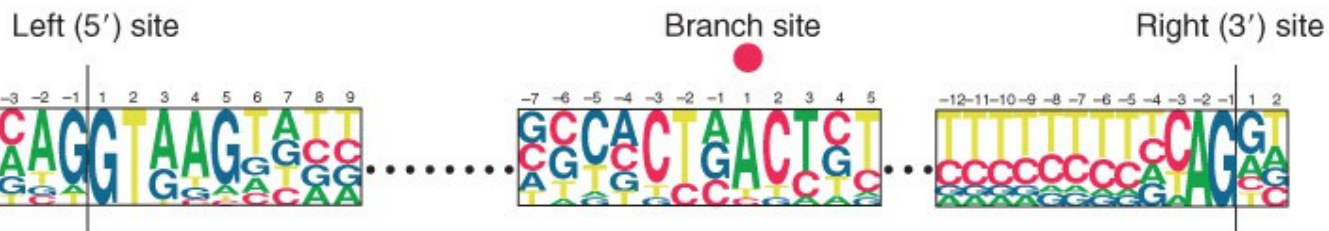


Alberts 4

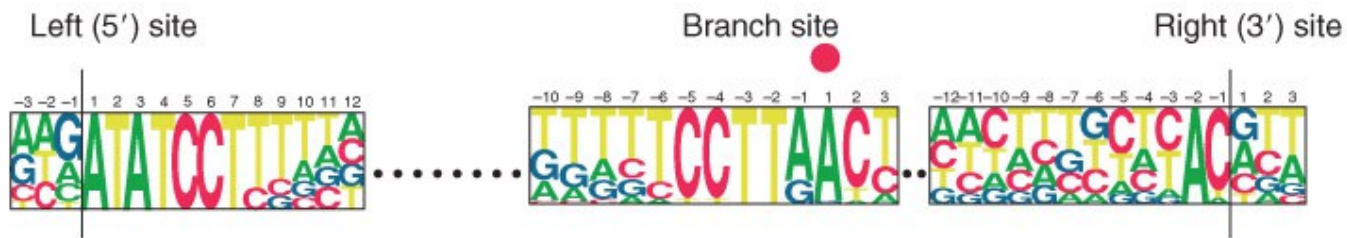
Porazdelitev dolžin eksonov in intronov pri evkariontih



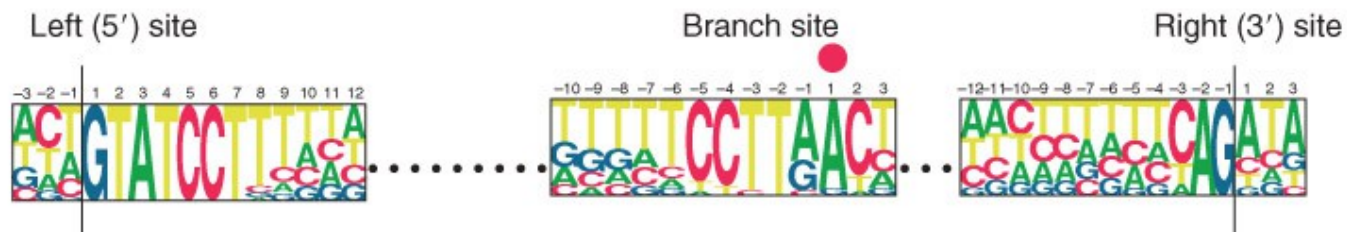
Splicing signals for major (U2-type or GU-AG) introns



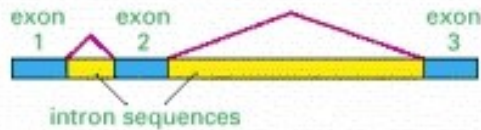
Splicing signals for minor (U12-type or AU-AC) introns



Splicing signals for minor (U12-type) introns that are flanked by GU and AG at ends

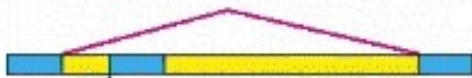


(A) NORMAL ADULT β -GLOBIN PRIMARY RNA TRANSCRIPT



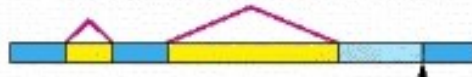
normal mRNA is formed from three exons

(B) SOME SINGLE-NUCLEOTIDE CHANGES THAT DESTROY A NORMAL SPLICE SITE CAUSE EXON SKIPPING



mRNA with exon 2 missing

(C) SOME SINGLE-NUCLEOTIDE CHANGES THAT DESTROY NORMAL SPLICE SITES ACTIVATE CRYPTIC SPLICE SITES



mRNA with extended exon 3

(D) SOME SINGLE-NUCLEOTIDE CHANGES THAT CREATE NEW SPLICE SITES CAUSE NEW EXONS TO BE INCORPORATED



mRNA with extra exon inserted between exon 2 and exon 3

Normal

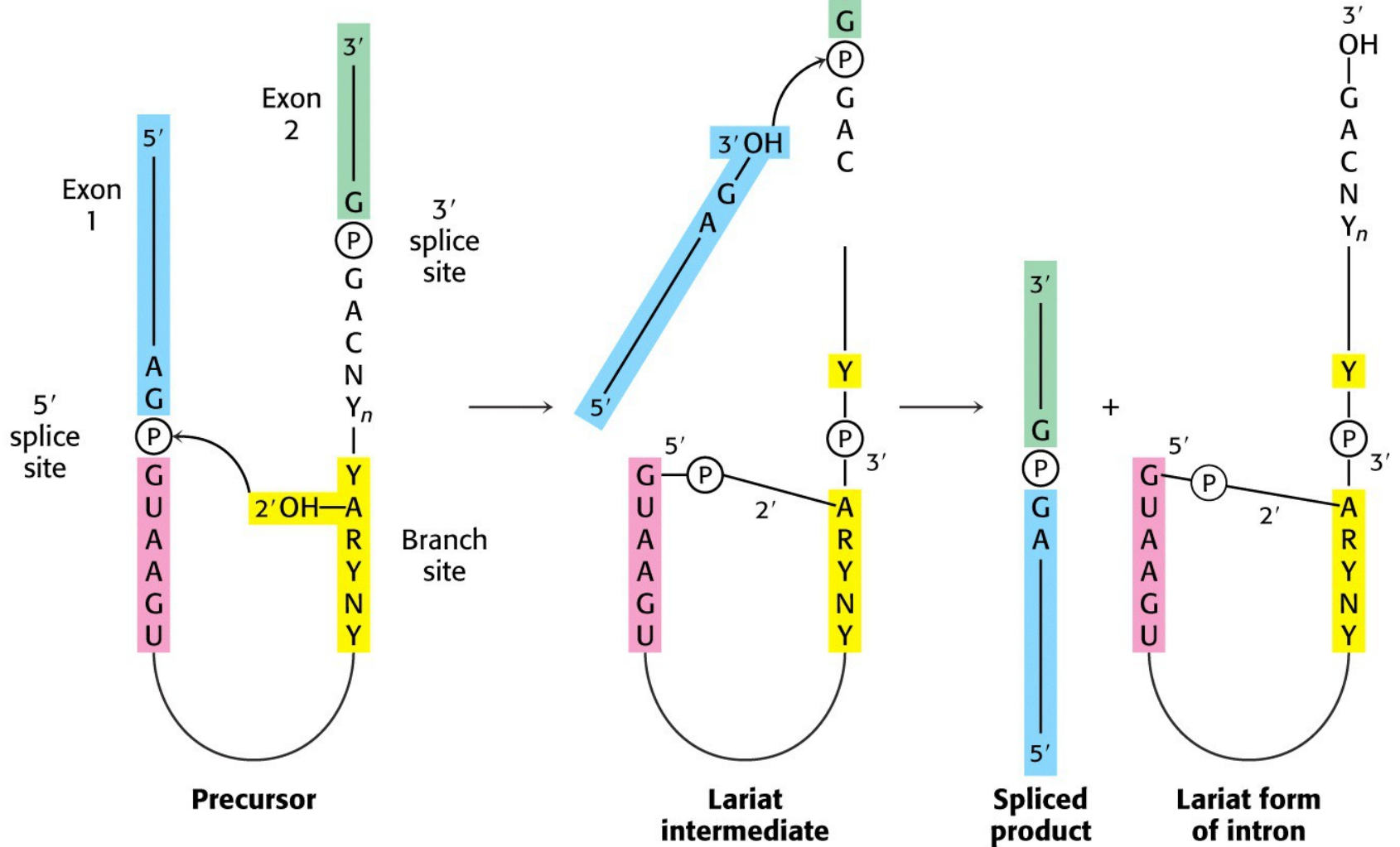
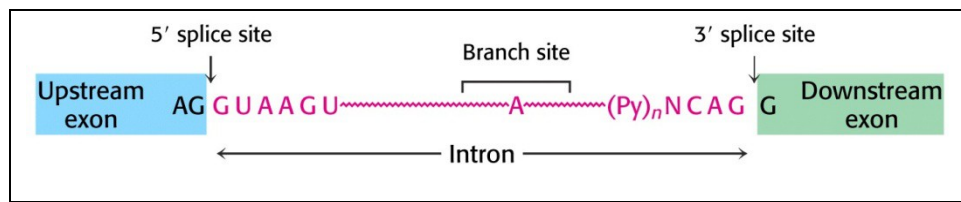
5' CCTATTGGTCTATTTTCCACCCTTAGGCTGCTG 3'

Normal 3' end of intron

β -Thalassemia

5' CCTATTAGTCTATTTTCCACCCTTAGGCTGCTG 3'





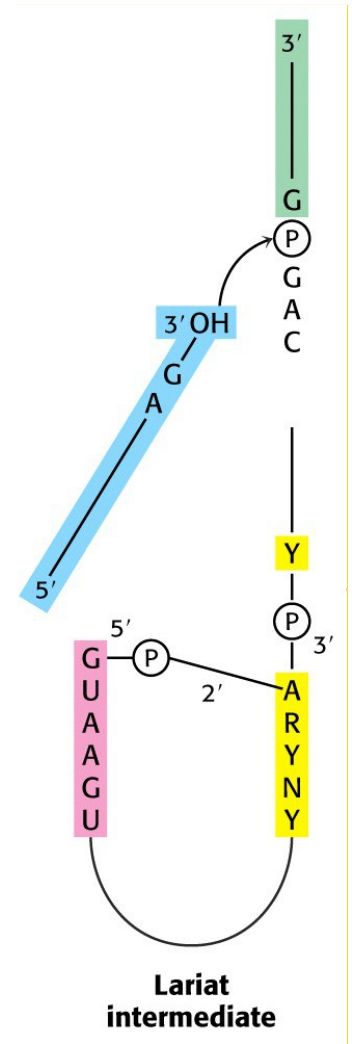
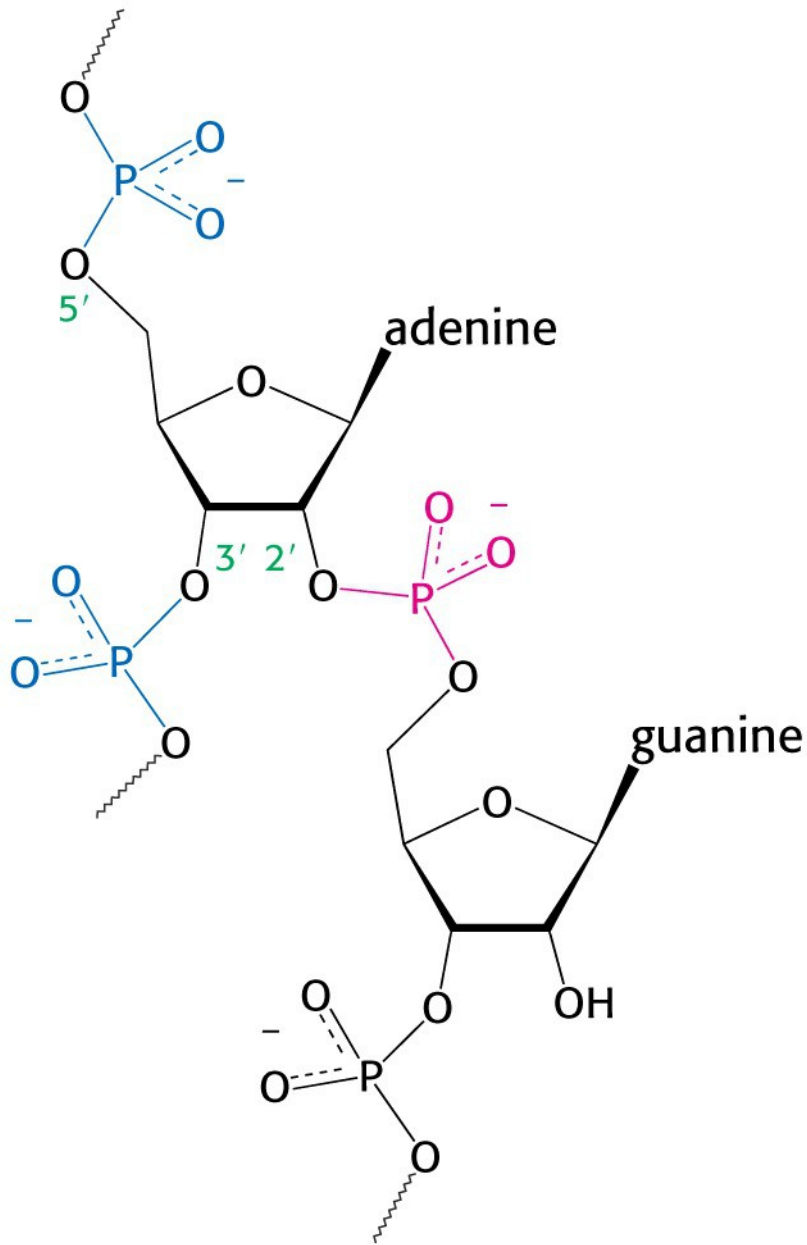
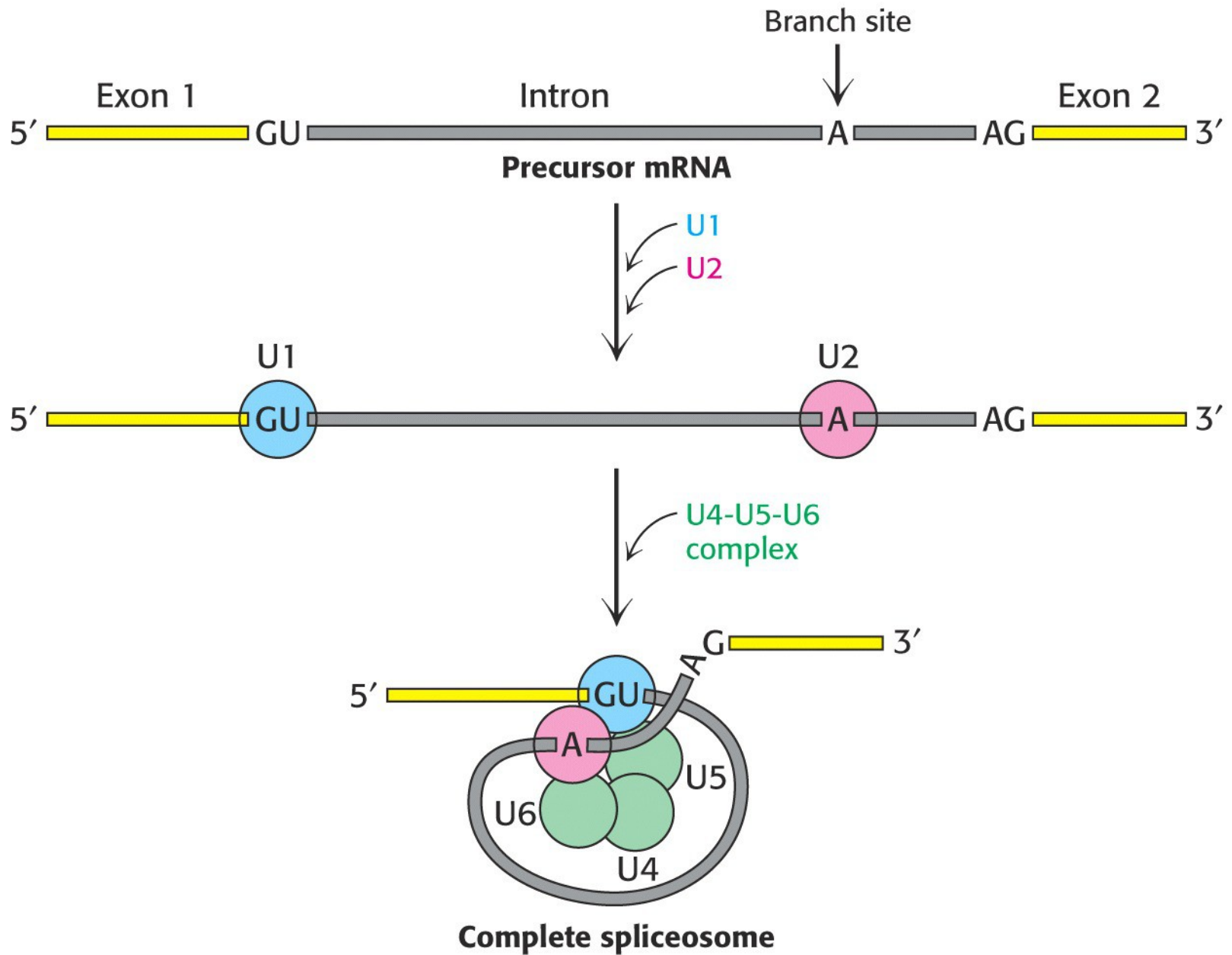
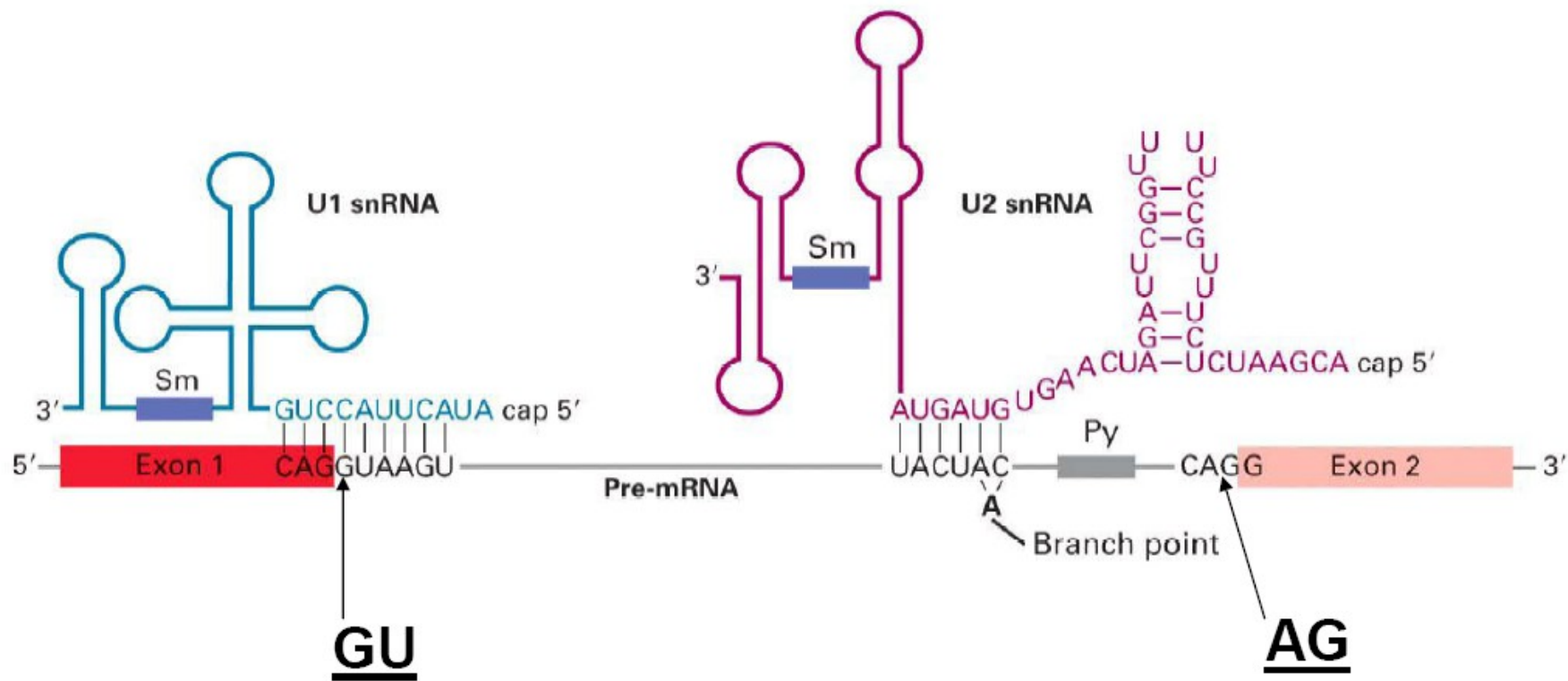


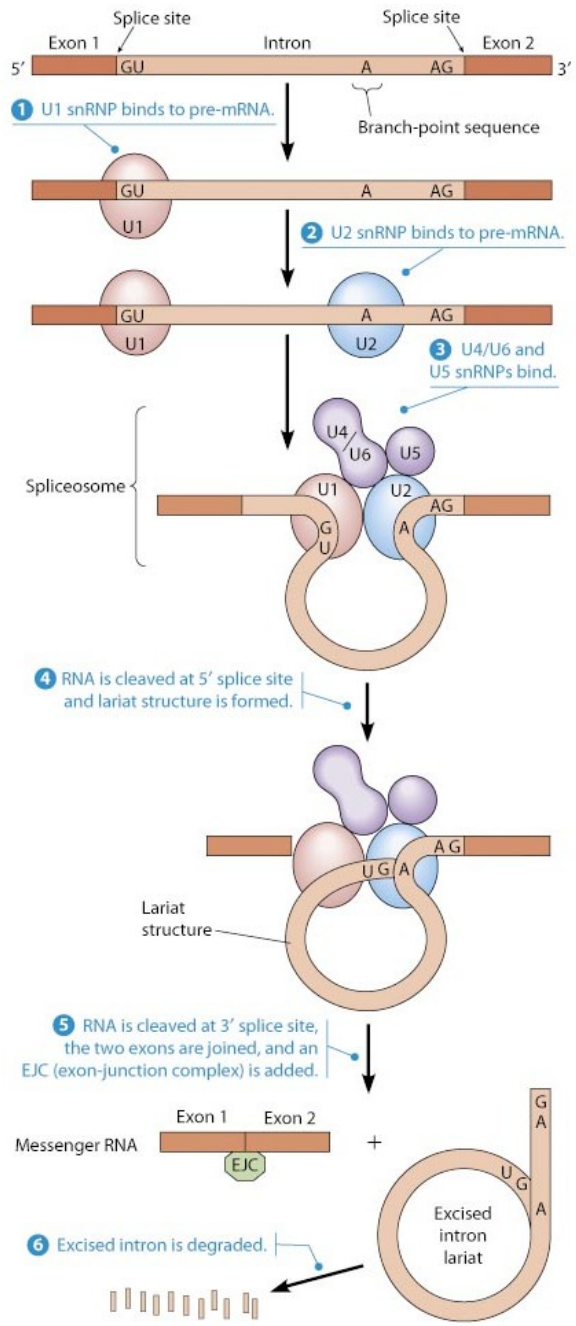
TABLE 28.3 Small nuclear ribonucleoprotein particles (snRNPs) in the splicing of mRNA precursors

snRNP	Size of snRNA (nucleotides)	Role
U1	165	Binds the 5' splice site and then the 3' splice site
U2	185	Binds the branch site and forms part of the catalytic center
U5	116	Binds the 5' splice site
U4	145	Masks the catalytic activity of U6
U6	106	Catalyzes splicing





Lodish Fig 12-8



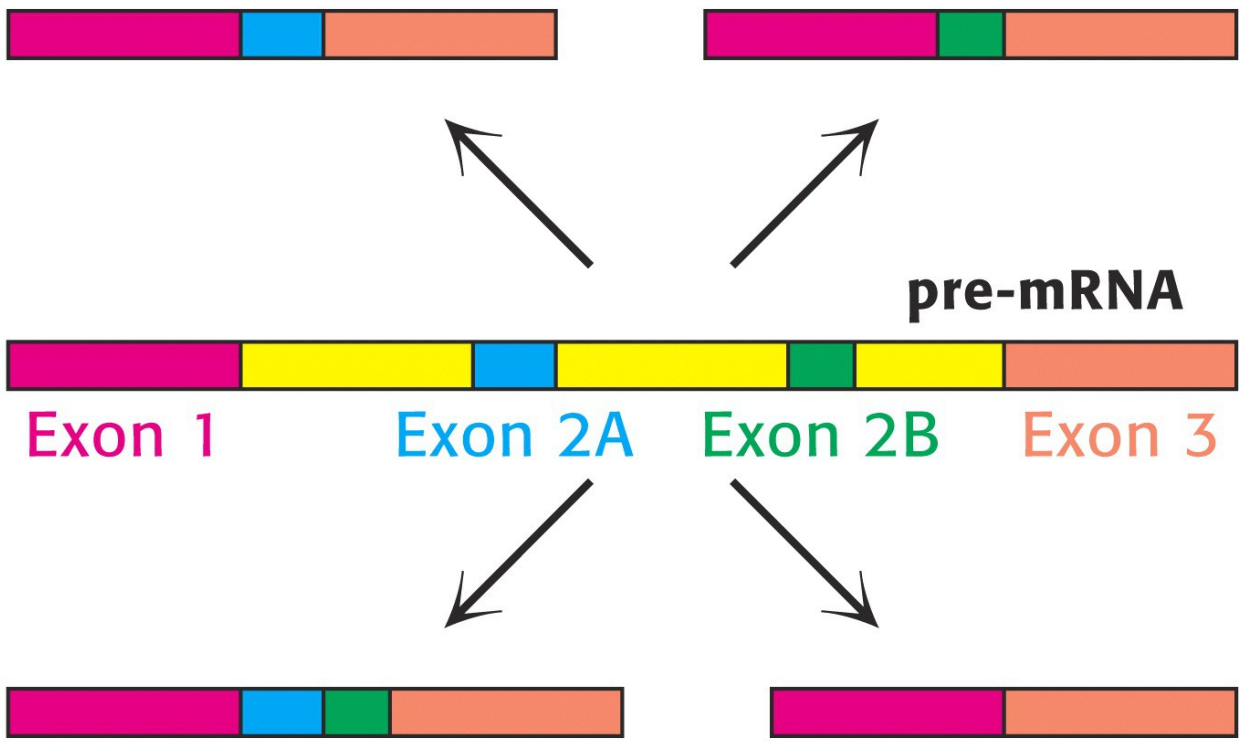
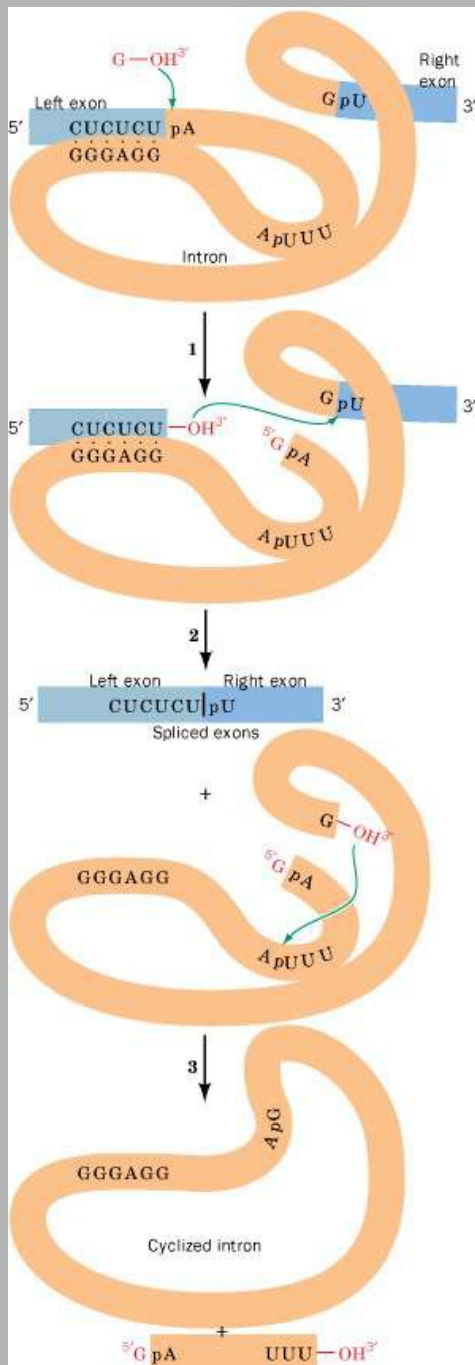


TABLE 28.4 Selected proteins exhibiting alternative RNA splicing

- Actin
- Alcohol dehydrogenase
- Aldolase
- K-ras
- Calcitonin
- Fibrinogen
- Fibronectin
- Myosin
- Nerve growth factor
- Tropomyosin
- Troponin

Source: R. E. Breitbart, A. Andreadis, and B. Nadal-Ginard. *Annu. Rev. Biochem.* 56(1987):467–495.



Samoizrezovalni introni tipa 1 pri migetalkarju *Tetrahymena*:

- * napad –OH skupine prostega G na fosfat na 5'-koncu introna
- * skupina –OH na 3'-koncu zgornjega eksona napade 5'-končni fosfat spodnjega eksona, pri čemer se sprostijo intron in spojena eksona
- * skupina –OH na 3'-koncu introna napade razvejitveno mesto v intronu, tako da nastane ciklični intron in odcepljen 5'-končni fragment (~15 nt)

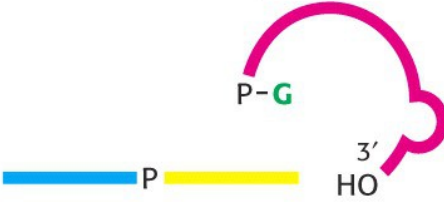
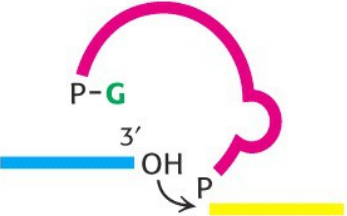
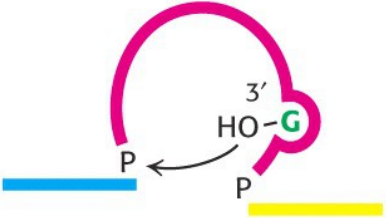
Intron Type	Where Found
GU–AG introns	Eukaryotic nuclear pre-mRNA
AU–AC introns	Eukaryotic nuclear pre-mRNA
Group I	Eukaryotic nuclear pre-mRNA, organelle RNAs, a few bacterial RNAs
Group II	Organelle RNAs, a few prokaryotic RNAs
Group III	Organelle RNAs
Twintrons (composites of two and/or more group II or III introns)	Organelle RNAs
Pre-tRNA introns	Eukaryotic nuclear pre-tRNAs
Archaeal introns	Various RNAs

Source: Brown, T.A., *Genomes* (2nd ed.), Wiley-Liss, p. 287 (2002).

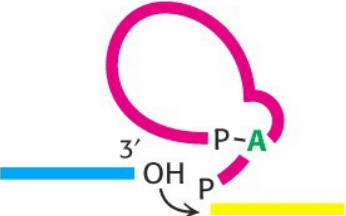
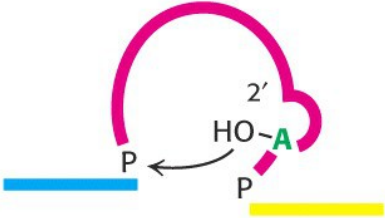
Znani tipi intronov pri evkariontih (7) in arhejah (1).

SELF-SPICING INTRONS

Group I

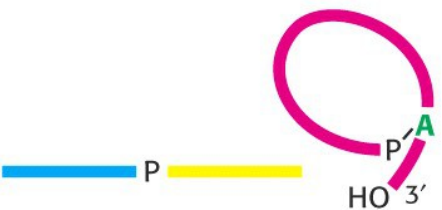
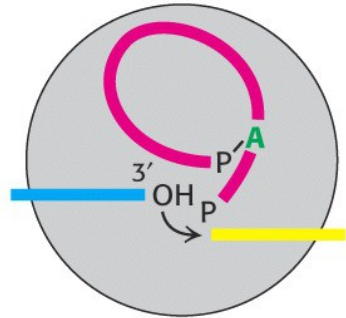
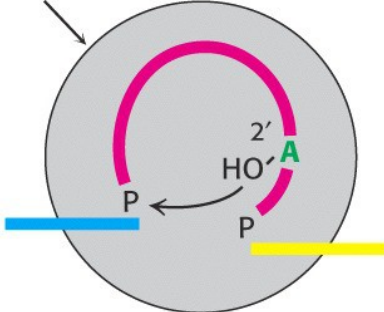


Group II

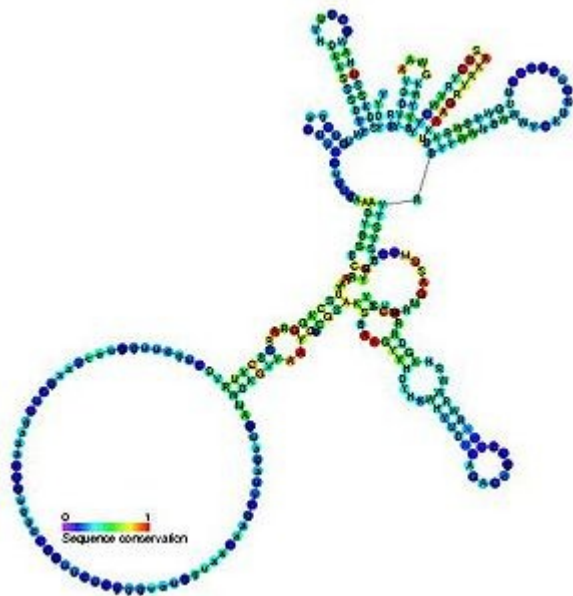


SPLICEOSOME-CATALYZED SPICING OF NUCLEAR mRNA

Spliceosome

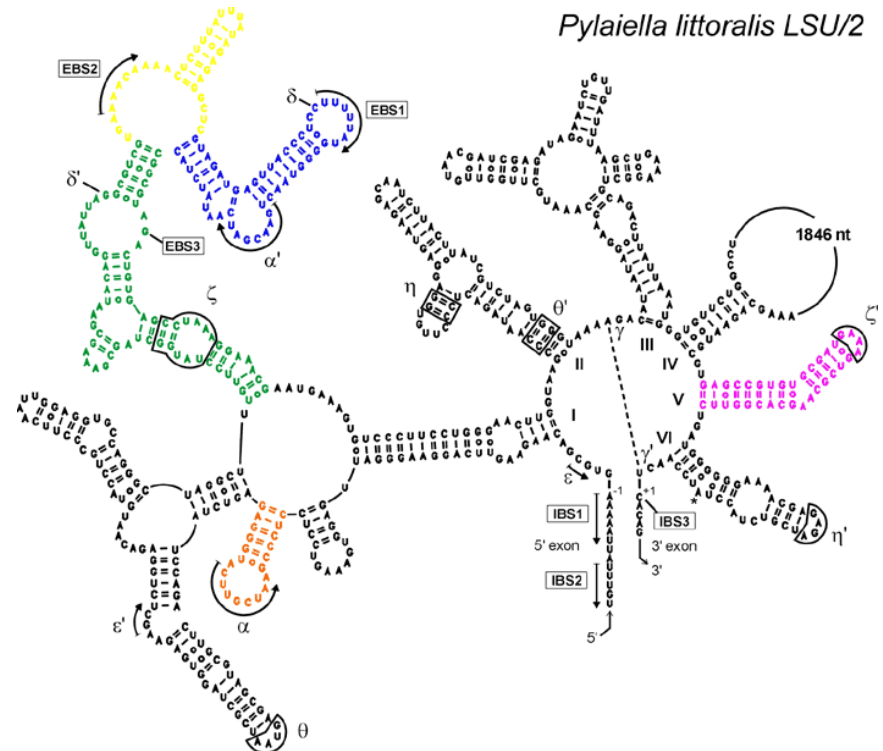


introni skupine I

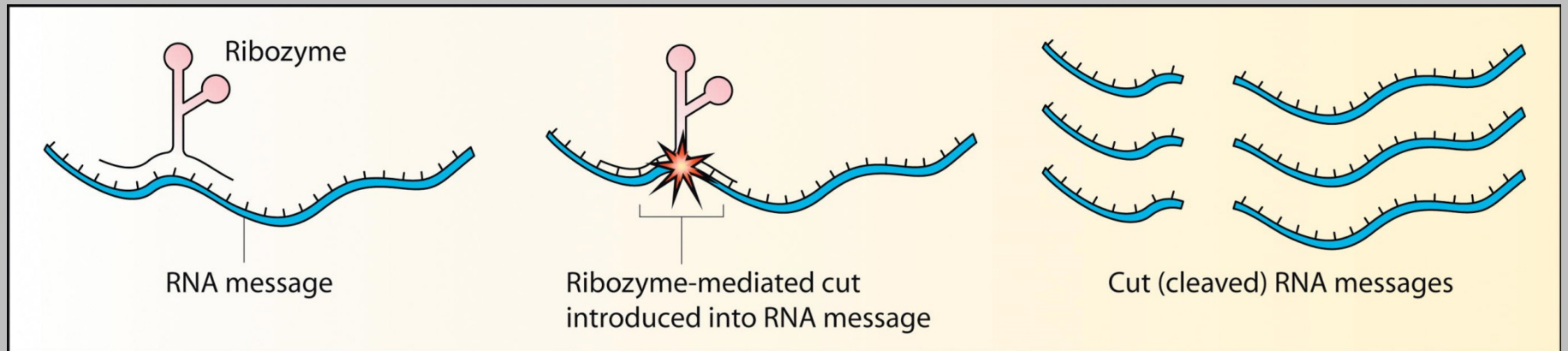
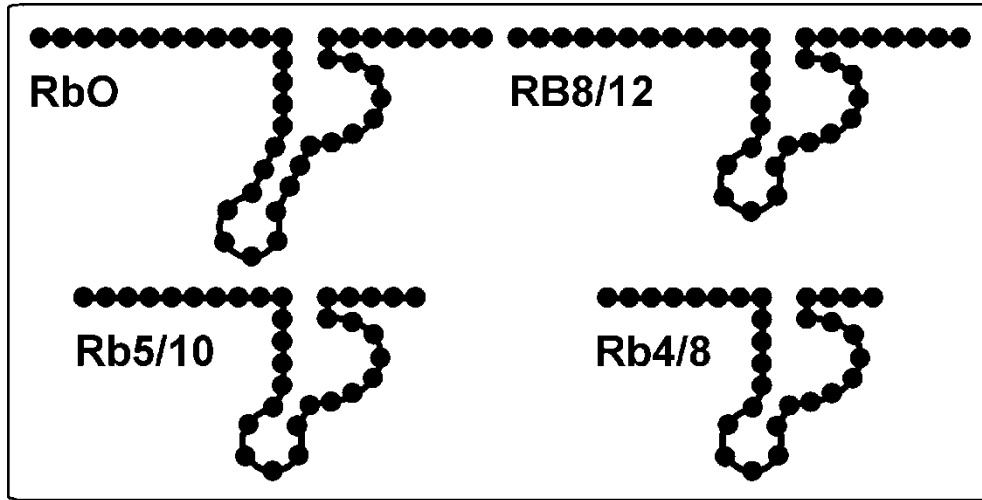


veliki
9 sparjenih regij
2 domeni
exoG

introni skupine II



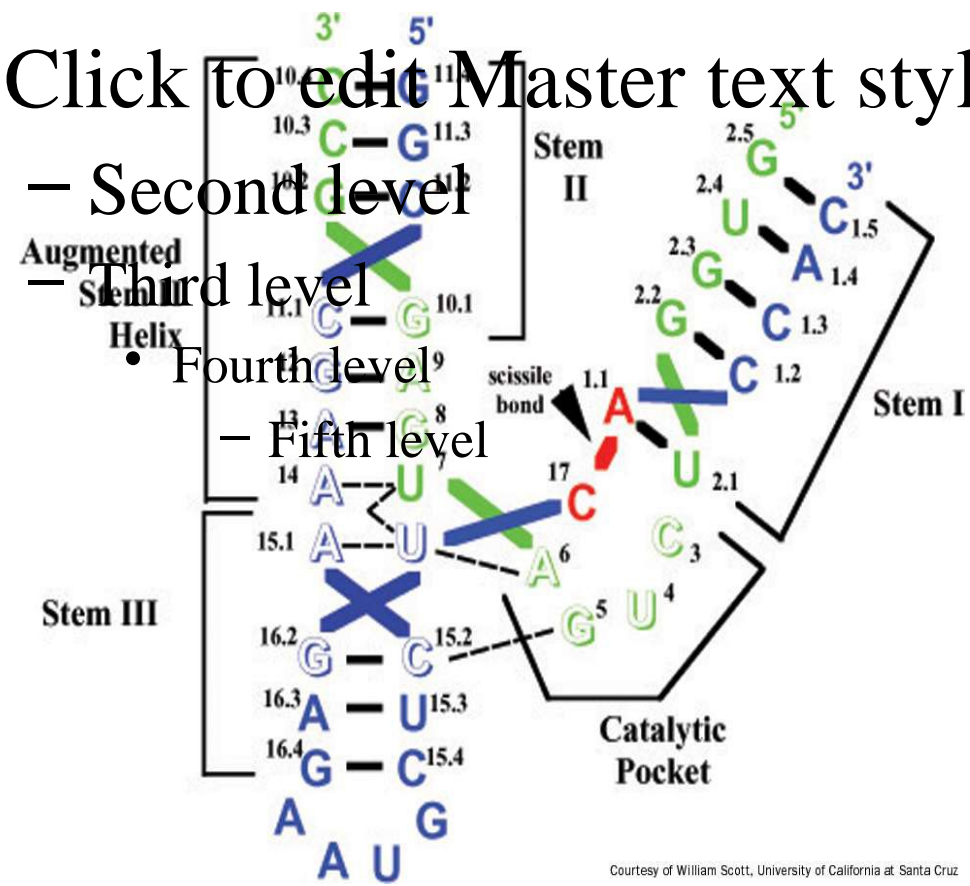
veliki
6 značilnih domen
notranji A (razvejitevno mesto)
in vivo potrebno sodelovanje proteinov



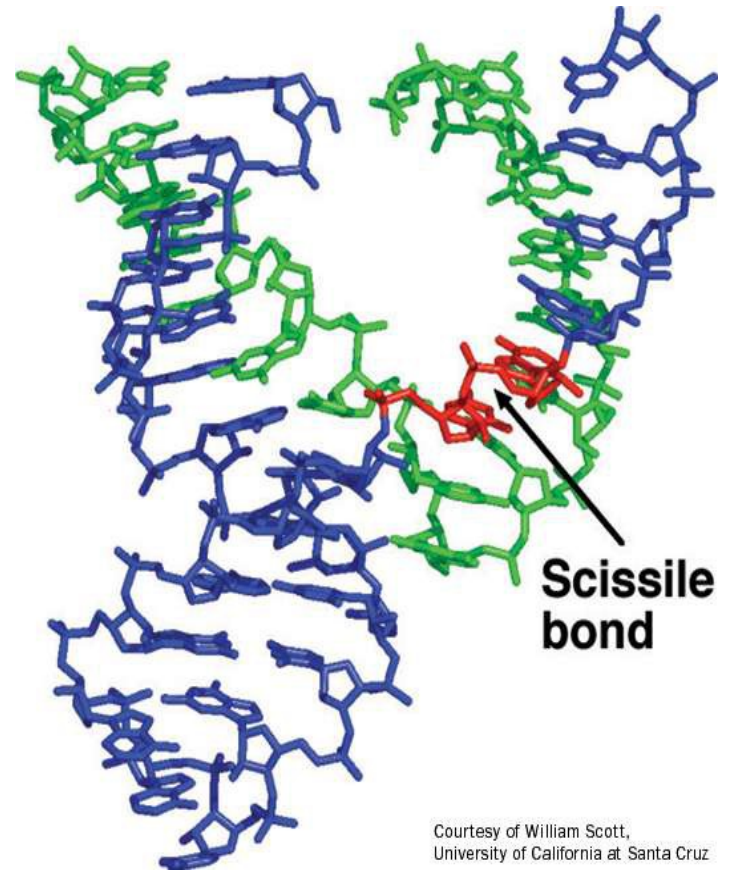
Rentgenska struktura ribocima z obliko kladiva ter shematska razlaga strukture:
 encim – zeleno, substrat – modro, mesto cepitve – rdeče.

Click to edit Master text styles

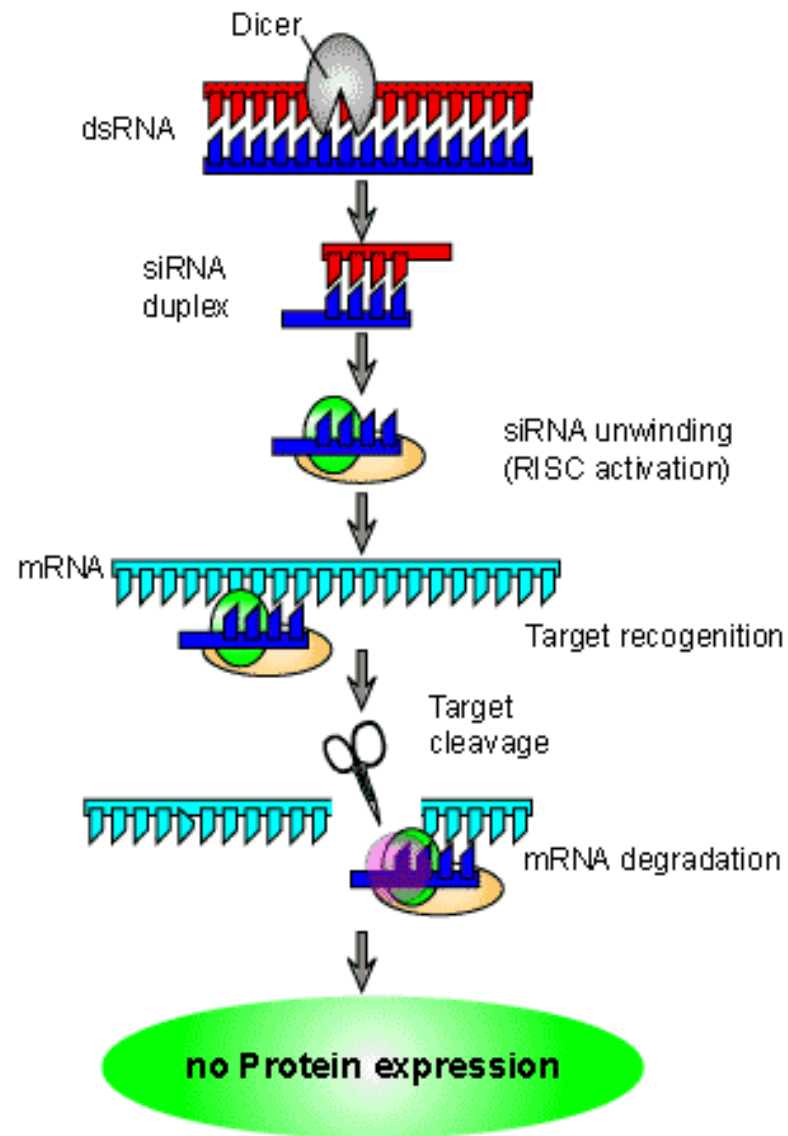
- Second level
- Third level
- Fourth level
- Fifth level

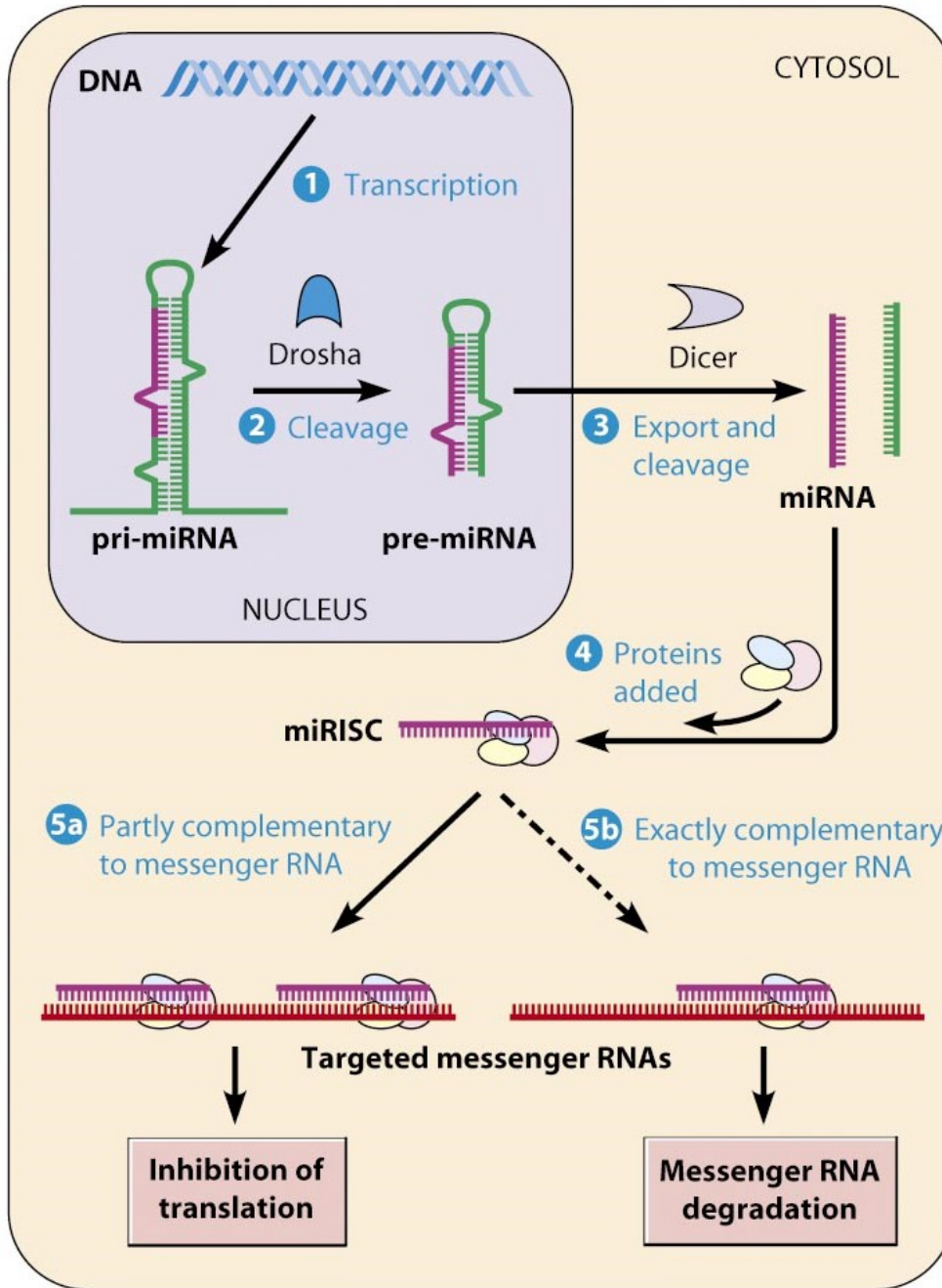


Courtesy of William Scott, University of California at Santa Cruz



Courtesy of William Scott, University of California at Santa Cruz





RNA-stikala (riboswitch) in RNA-termometri

- znotraj celice zaznavajo razmere v okolju
- preko svoje strukture sprožajo celični odziv
- so deli verige mRNA

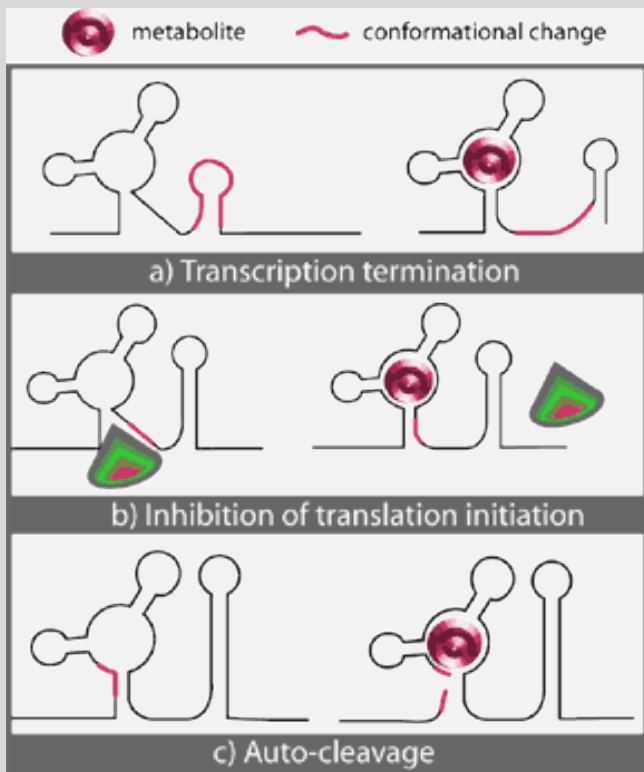
RNA-stikala

- zaznajo koncentracijo metabolita, katerega konc. uravnava produkt iste mRNA
- metabolit se veže na stikalo, ki s svojo strukturo spreminja raven izražanja gena

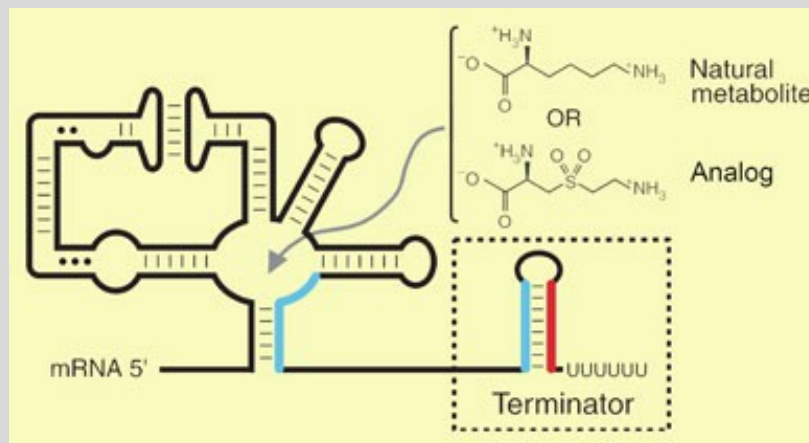
RNA-termometri

- sekund. / terc. strukturni elementi mRNA, ki lahko vklopijo/izklopijo translacijo

Zvitje RNA je pomemben proces za vlogo RNA v celici, nanj pa vplivajo dejavniki celičnega okolja (hitrost sinteze in razgradnje, temperatura, ligandi: kovinski ioni, poliamini, RNA-vezavni proteini).



Science Creative, 2011



Chemistry World, 2006