

(Eukaryotic) RNA Processing

Introduction

rRNA, tRNA and mRNA processing

1-mRNA capping at the 5' end (Euk)

Cap structure & Biological Roles

Mechanisms of Cap addition

2-mRNA Polyadenylation at the 3' end

Cap structure & Biological Roles

Mechanisms of RNA Degradation

Mechanism of polyA addition

3-mRNA Splicing

A-Splicing sites and signals/
chemical mechanism

B-Spliceosome assembly
and catalysis

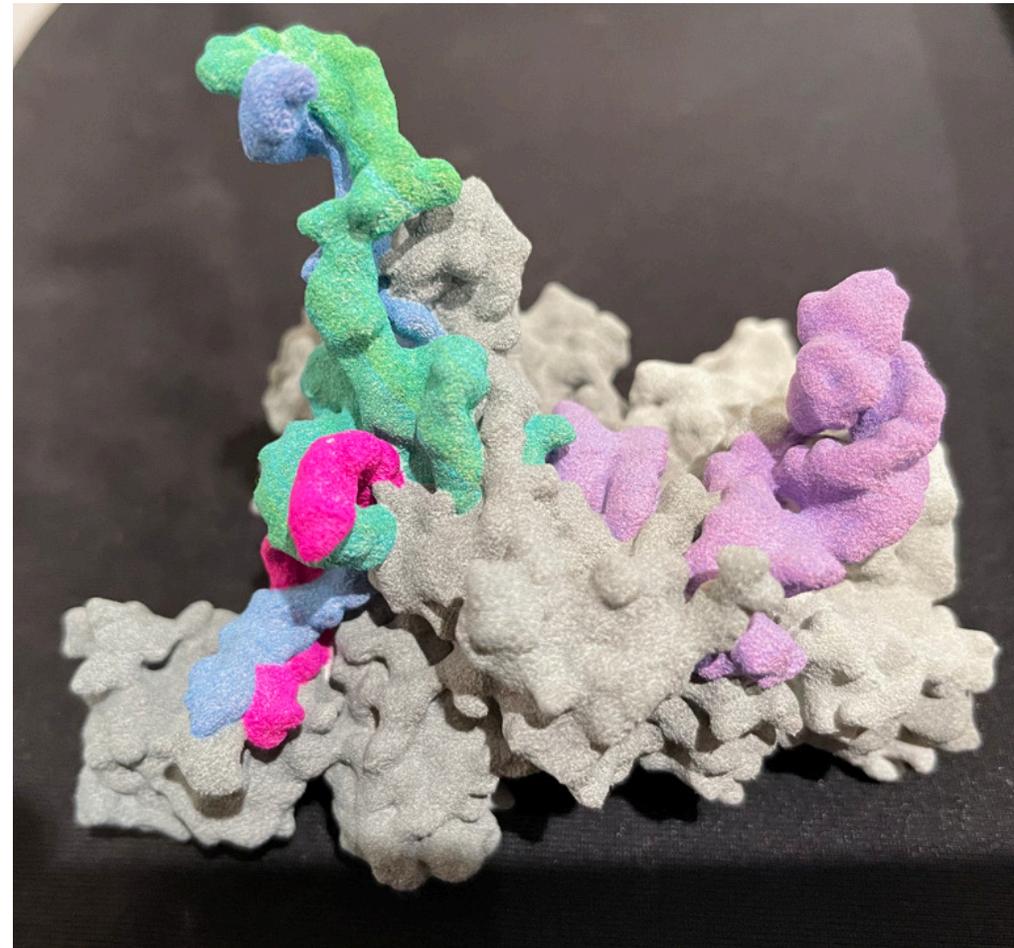
4-Significance of mRNA splicing
generating genetic diversity

5-Coupling of Processing to Transcription

6-Splicing Ribozymes

-Group I introns

-Group II introns



The Spliceosome:
3D-printed version!

Not covered:

rRNA, tRNA (no details)

RNA editing /modification

Learning outcomes:

What you need to know/understand after this unit

Know the major RNA processing events for Pol.I/II/III transcripts

Understand the mechanisms of mRNA 5' cap and 3'-end polyA formation and of RNA degradation

Understand the mechanisms of splicing by the spliceosome and how the spliceosome recognize splice sites and promotes catalysis

Understand the biological roles of 5'-cap, 3'-polyA and splicing

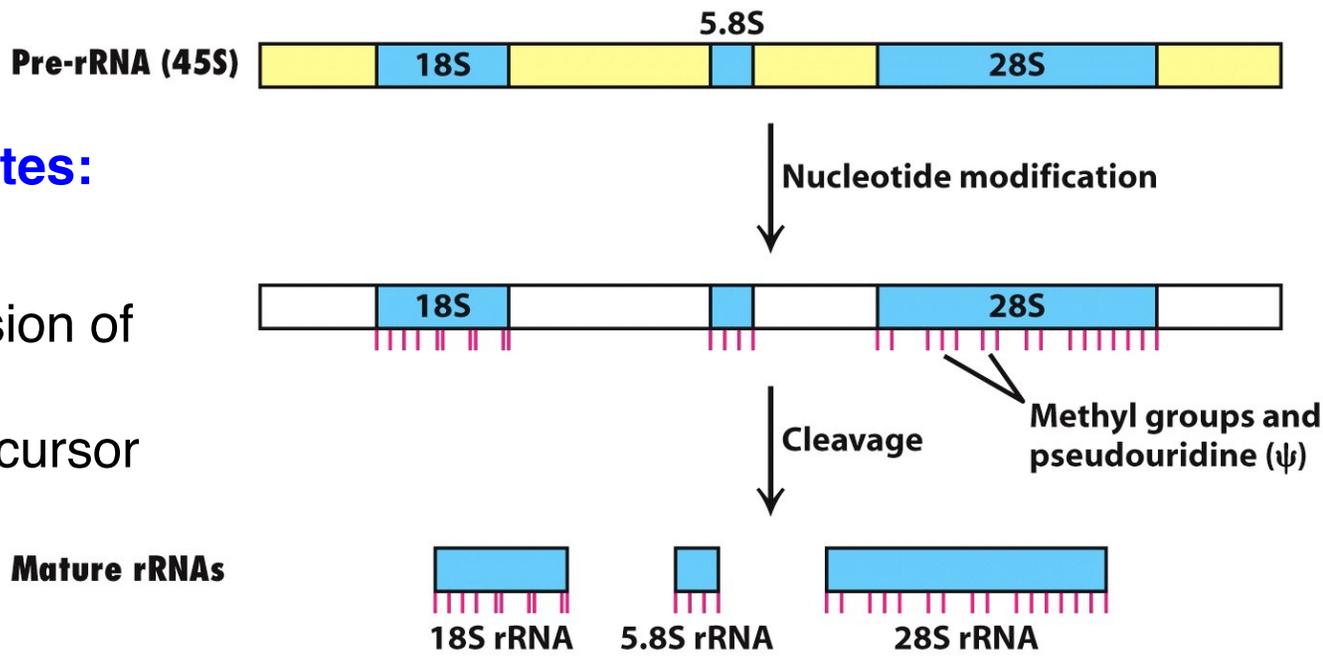
Understand the mechanisms of RNA-catalyzed splicing by group I and group II introns

Know the 2-metal ion model of catalysis for RNA processing reactions

Processing of major classes of RNA transcripts in Eukaryotes:

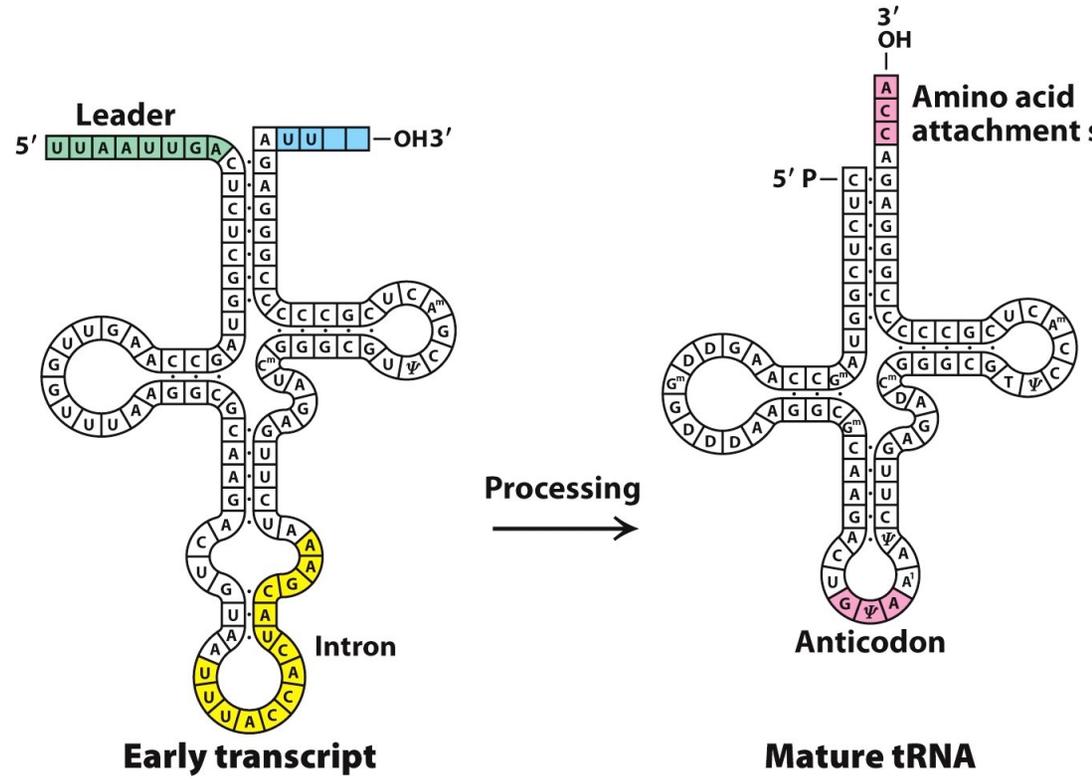
Ribosomal RNAs (Pol.I):

- 2'-O-methylation and conversion of U to pseudo-U (ψ)
- cleavage of the pre-rRNA precursor
- Exonucleolytic processing to the mature ends



tRNAs (Pol.III):

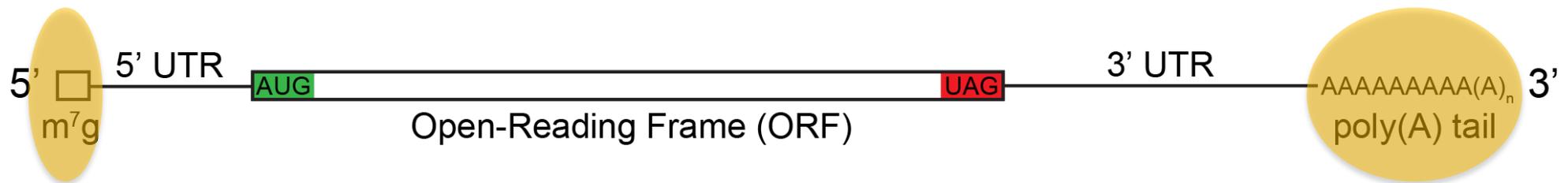
- Splicing of short intron
- Cleavage of the 5' leader (RNase P)
- Cleavage of the 3' end and addition of CCA trinucleotide sequence
- Nucleotides modifications (methylation, Inosine, ψ , etc)



mRNAs (Pol.II):

- 5'-end capping
- polyadenylation (3'-end)
- Splicing of introns
- editing (A->I, U insertion/del)
- modifications (m6A, Inosine...)

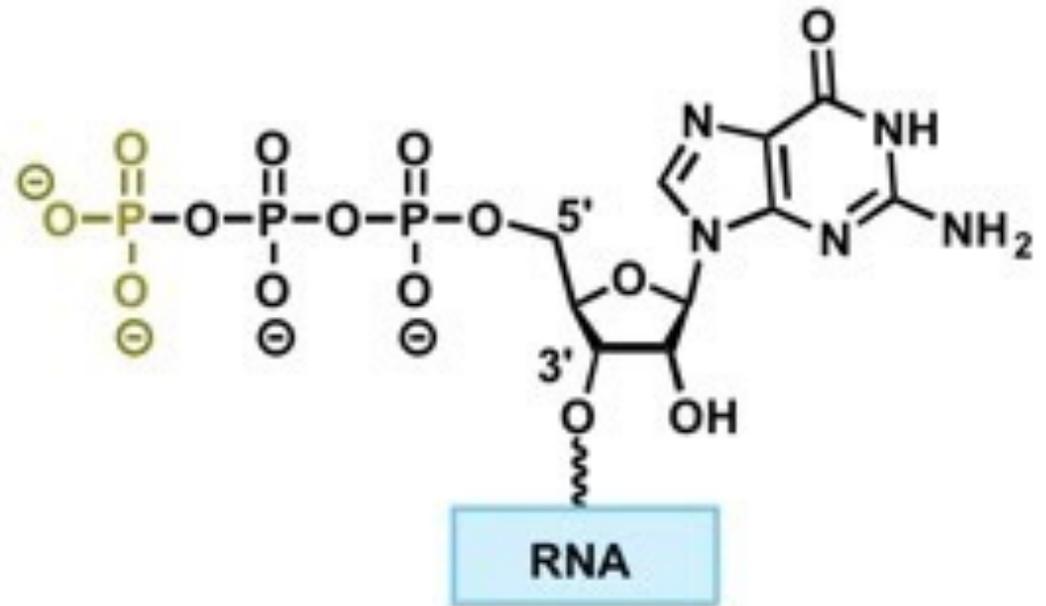
A mature eukaryotic mRNA after processing



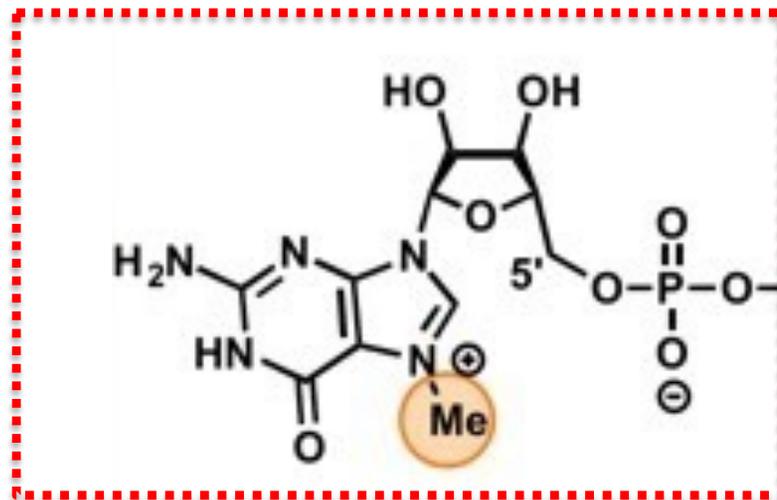
Poly(A) tail length:
70-80 nt in yeast
~200 nt in humans

Highlighted elements are not encoded within the genes: they are added after transcription/co-transcriptionally

RNA 5'-end as it comes out of the RNA polymerase:



The 5' Cap structure of eukaryotic mRNAs



Extra CH₃ groups

Unusual 5' ppp5' linkage !!!

