AQC-321

rRNA & tRNA Processing

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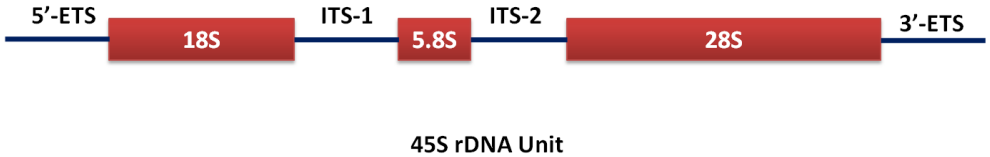
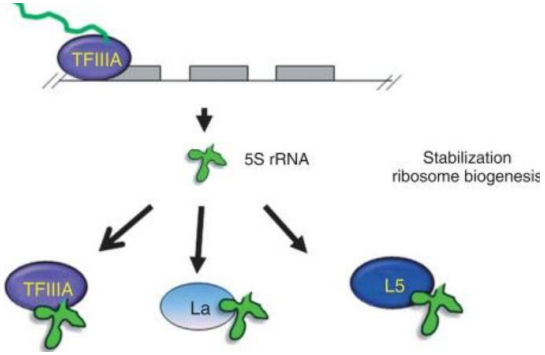


45S rDNA Unit

5S rDNA Unit

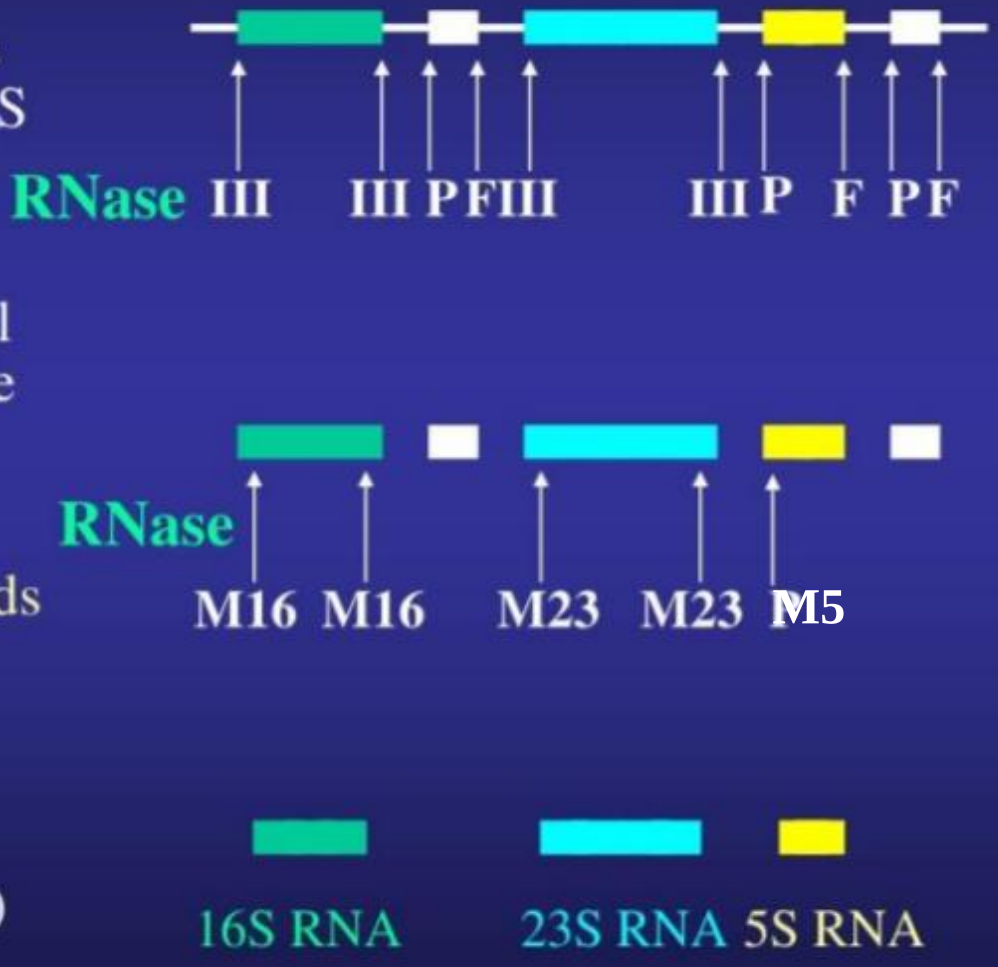


rRNA processing in prokaryotes

Process in *E. coli* :

- There are seven rRNA operons in *E. coli*, each operon contains one copy of the 5S, 16S and 23S rRNA coding regions, together with some tRNA (1~4);

1. By RNA polymerases, an initial 30S (6000 nt) transcript is made from one of the seven rRNA operons;
2. This 6000 nt transcript then folds and complexes with proteins;
3. 24 specific base methylations;
4. Cleavage by specific nucleases (RNase III, M5, M16 and M23) to release the mature rRNAs.



Eukaryotic Ribosomal RNA genes (rDNA)

In higher eukaryotes, ribosomal RNA genes (rDNAs) are arranged in two different families, the nucleolus forming major rDNA (45S rDNA) family transcribed by RNA polymerase I and non-nucleolus forming minor rDNA (5S rDNA) family transcribed by RNA polymerase III.

RNA Pol I

45S rDNA Unit

RNA Pol III

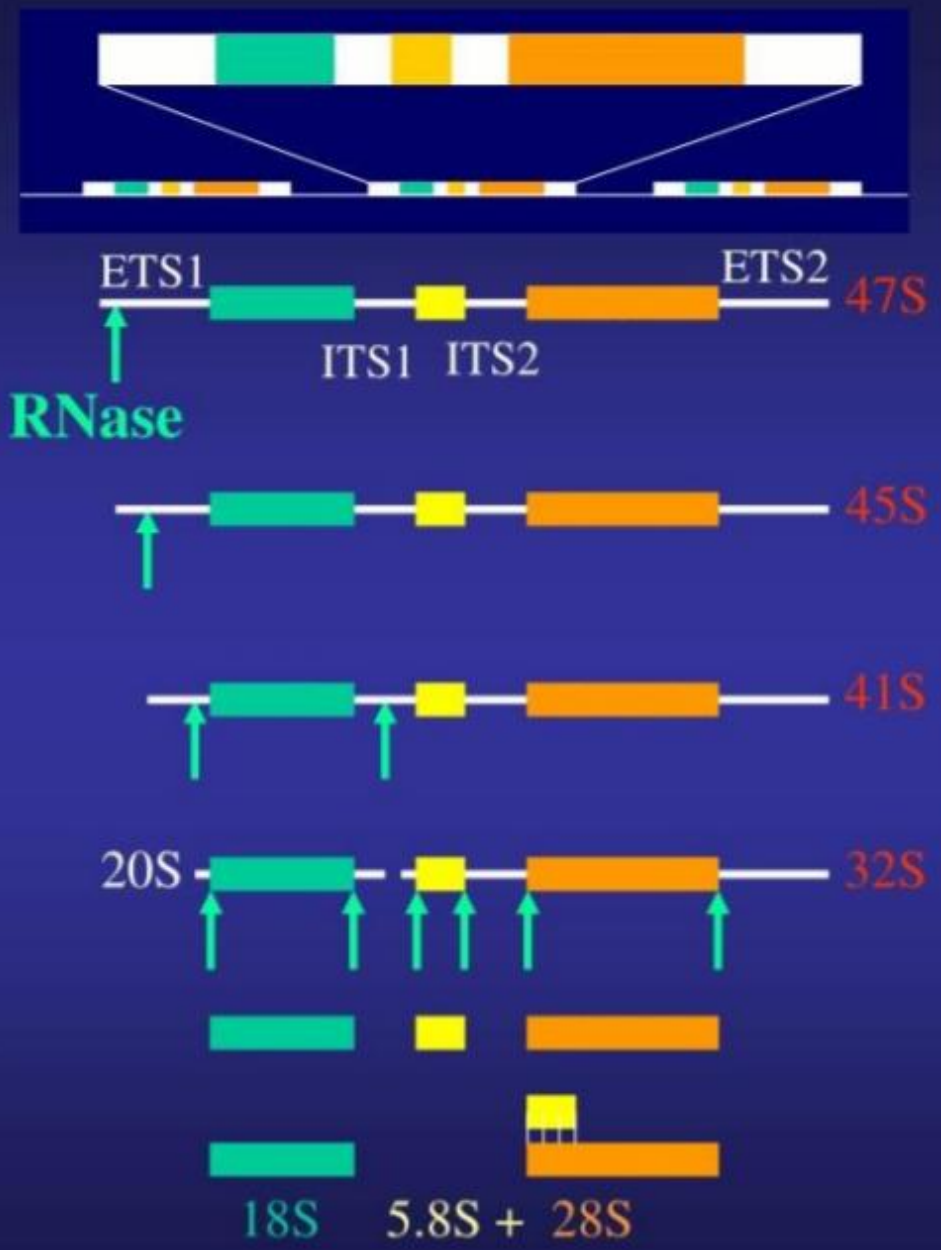
5S rDNA Unit

rRNA processing in eukaryotes

Process in mammals:

- rRNA genes are present in a tandemly repeated cluster containing 100 or more copies of the transcription unit (M2);

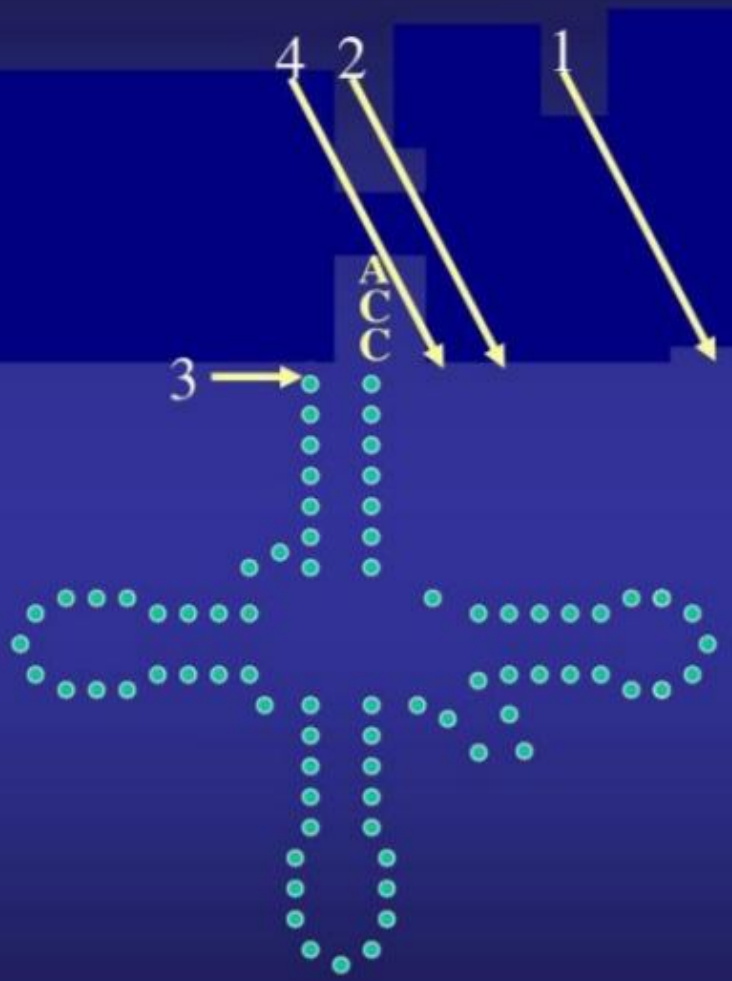
1. By RNA polymerases I, an initial 47S (13500 nt) transcript is made from one of the units;
2. Cleavages: firstly in the **external transcribed spacers** (ETSs) 1 and 2;
3. Cleavages: then in the **internal transcribed spacer** (ITSs);
4. The 5.8S region base-pair to the 28S rRNA before the mature molecules are produced



tRNA processing in prokaryotes

The processing of $tRNA^{Tyr}$ of *E. coli* :

- Mature tRNAs are generated by processing longer pre-tRNA transcripts:



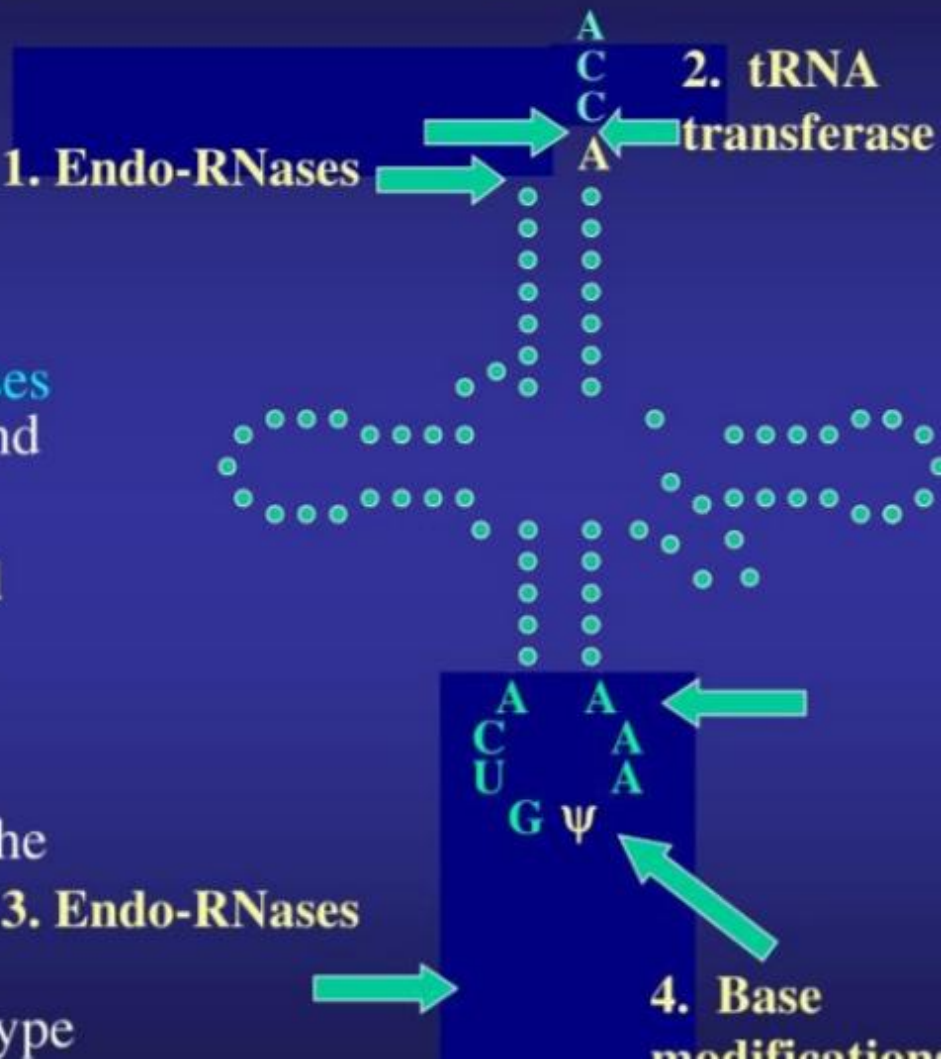
- Specific exo- and endo-nucleolytic cleavages by RNases D, E, F and P
  1. Endo-RNase E or F cleave 3'-end;
  2. Exo-RNase D trims the 3'-end to within 2 nt of mature length;
  3. Endo-RNase P can then cut to give the mature 5'-end;
  4. Exo-RNase D finally removes the two 3'-residues.
- Base modifications: which are unique to each particular tRNA type.

tRNA processing in eukaryotes

The processing of $tRNA^{Tyr}$ of yeast:

- Mature tRNAs are generated by processing longer pre-tRNA with a 16 nt 5'-leader, a 14 nt intron and a 2 nt 3'-end:

1. Specific cleavages by endo-RNases for 16nt 5'-leader and a 2nt 3'-end
2. tRNA transferase adds the sequence 5'-CCA-3' to the 3'-end to generate the mature 3'-end of the tRNA;
3. Removal of the intron by endo-RNases followed by ligation of the half molecules of tRNA;
4. Base modifications: which are unique to each particular tRNA type



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