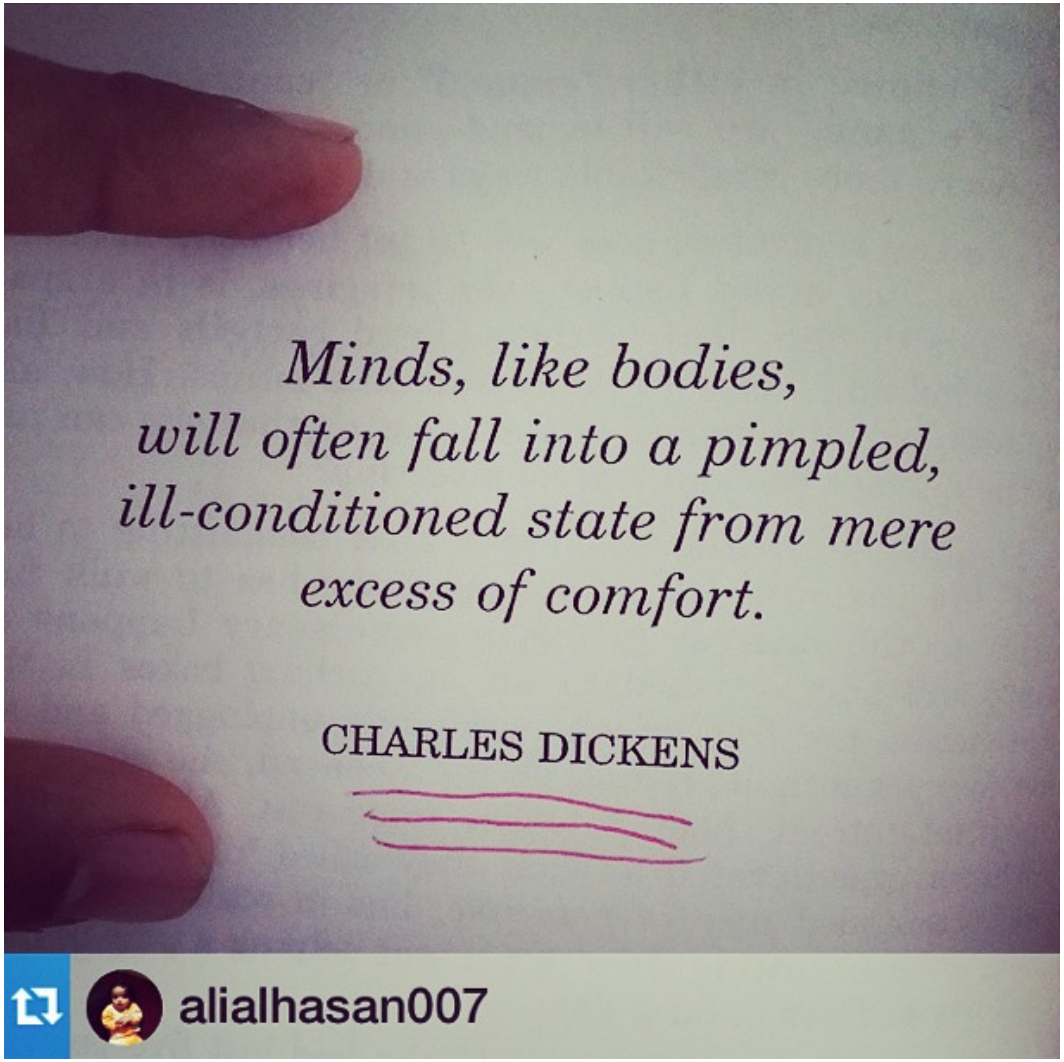
Lecture 23:

Translation in eukaryotes

Course 371

Lessons for life



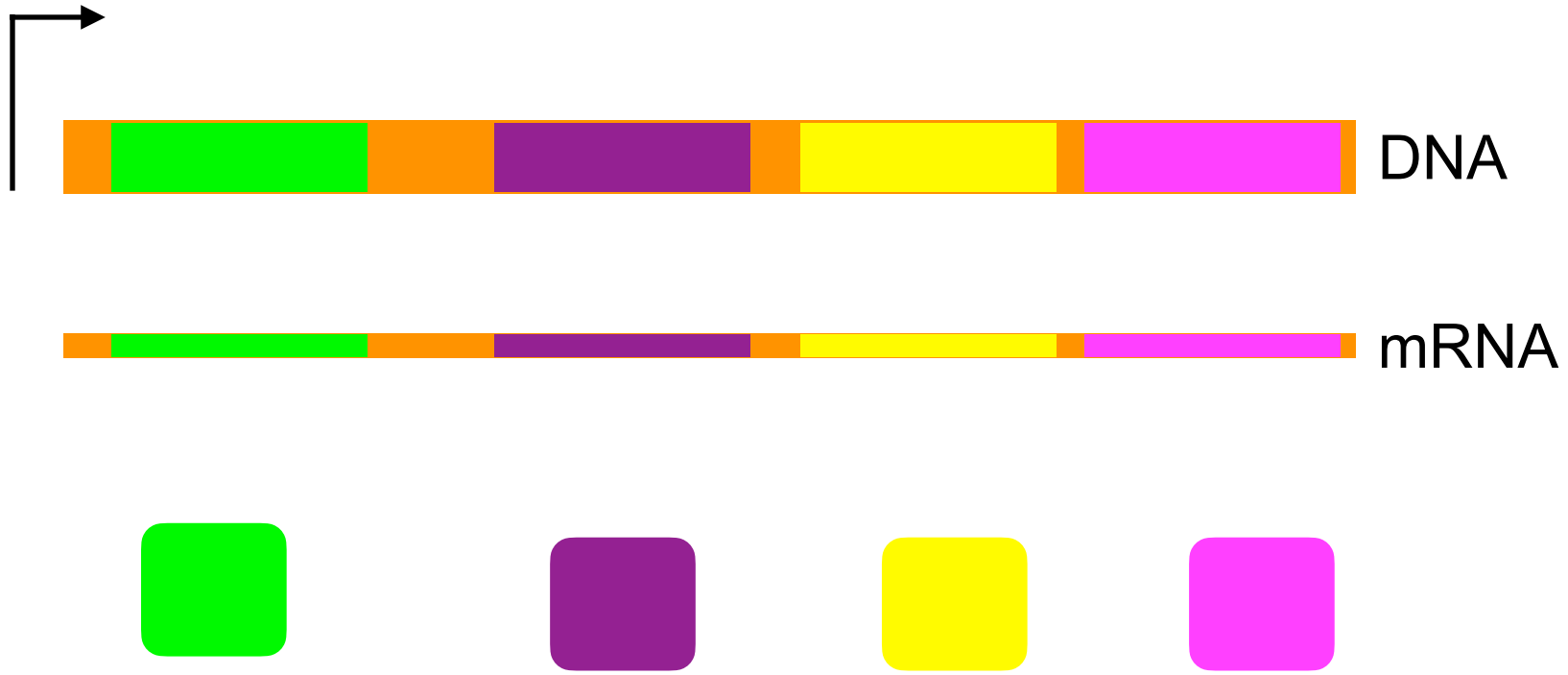
AIMS

- Understand the process of translation in eukaryotes.
- Understand the molecular requirements to translate a eukaryotic mRNA into a protein.
- Understand the sequence of events in eukaryotic translation.
- Understand the differences between prokaryotic and eukaryotic translation.

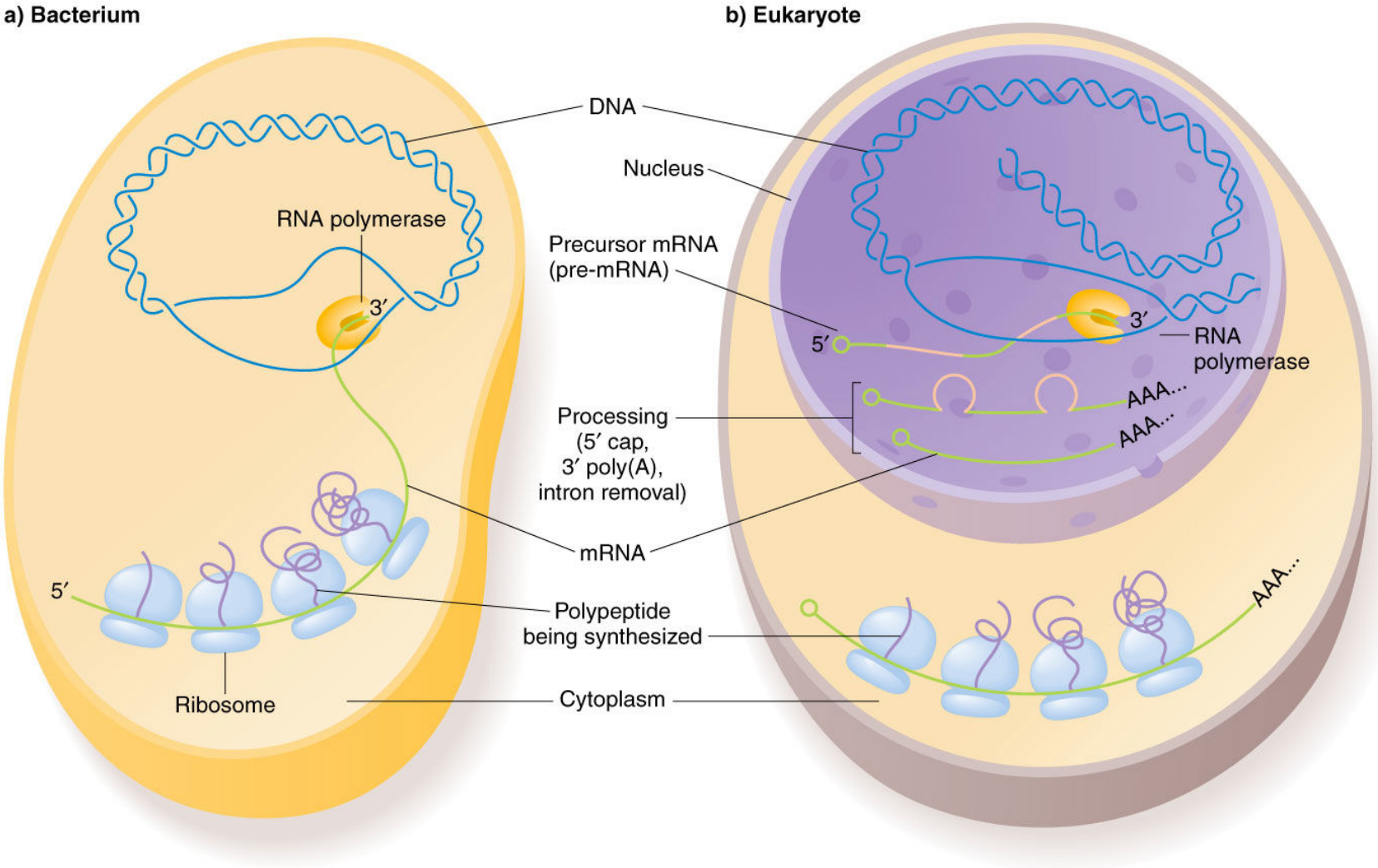
Summary and review

Prokaryotes	Eukaryotes
No nucleus	Nucleus
DNA in cytoplasm	DNA in nucleus
Transcription in cytoplasm	Transcription in nucleus
Translation in cytoplasm	Translation in cytoplasm
Polycistronic transcripts (one transcript many genes)	**Monocistronic** transcript (one transcript one gene)
Coupled transcription and translation	Transcription and translation **NOT** coupled
mRNA not processed	mRNA processed
One RNA polymerase	Many RNA polymerases

Summary and review

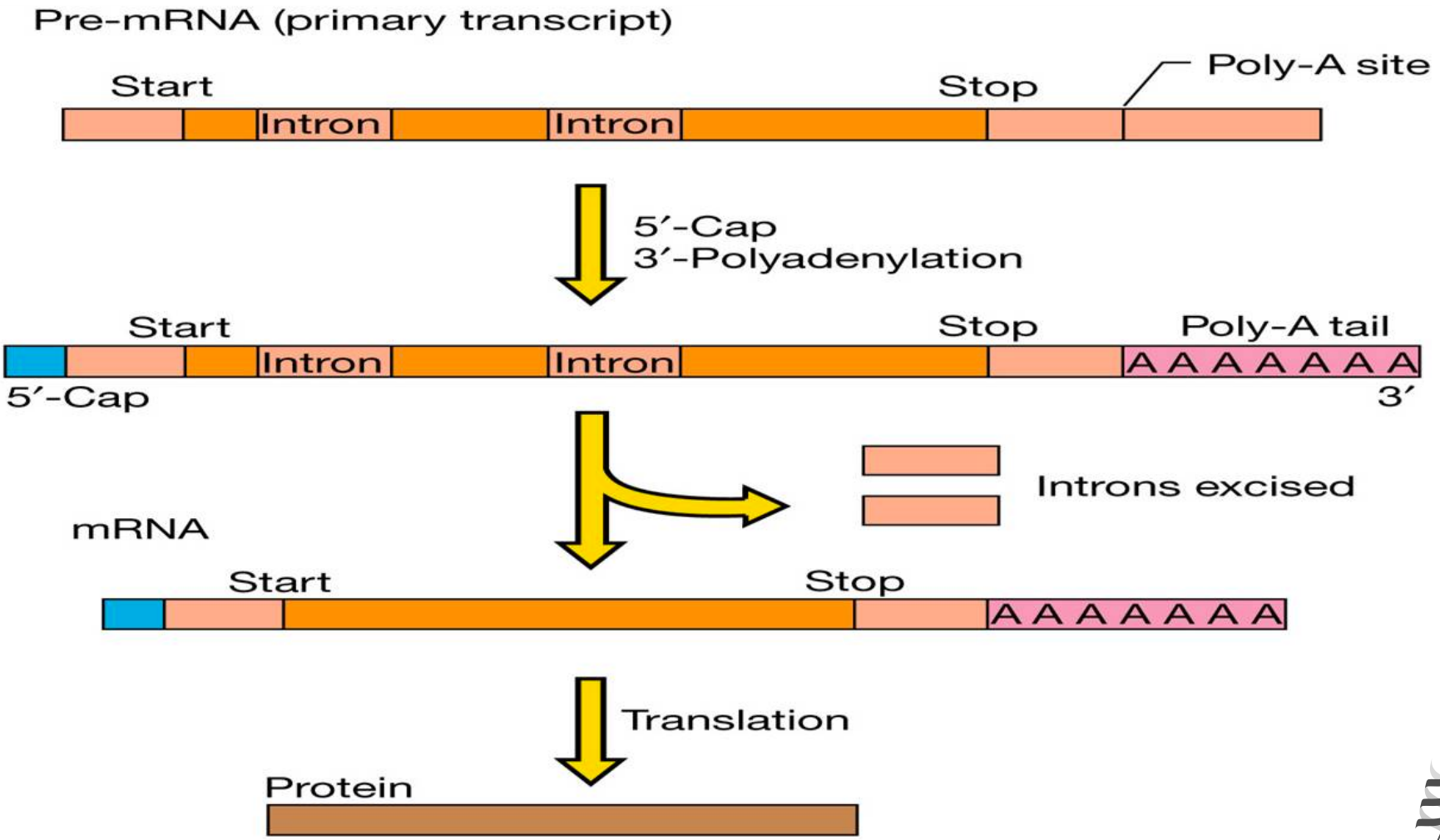


Summary and review



Review

Eukaryotic mRNA



Eukaryotic translation

- Eukaryotic translation is similar to that of prokaryotes but a bit more complex.
- Differences in the translation process are due to differences in transcript structure and location of translation.

Eukaryotic translation

What are the stages of protein synthesis in eukaryotes?

(1) Initiation
(2) Elongation
(3) Termination

Eukaryotic translation initiation

What is needed for translation initiation?

1. Mature mRNA
2. Ribosome
3. Eukaryotic initiation factors (eIFs)
4. GTP
5. Initiator tRNA (Met-tRNA)

Eukaryotic translation initiation

Differences between eukaryotic and prokaryotic translation initiation?

1. No Shine-Dalgarno sequence in eukaryotes

2. No modified initiator tRNA (fMet-tRNA)

How does the ribosome know where to start?

Eukaryotic translation initiation

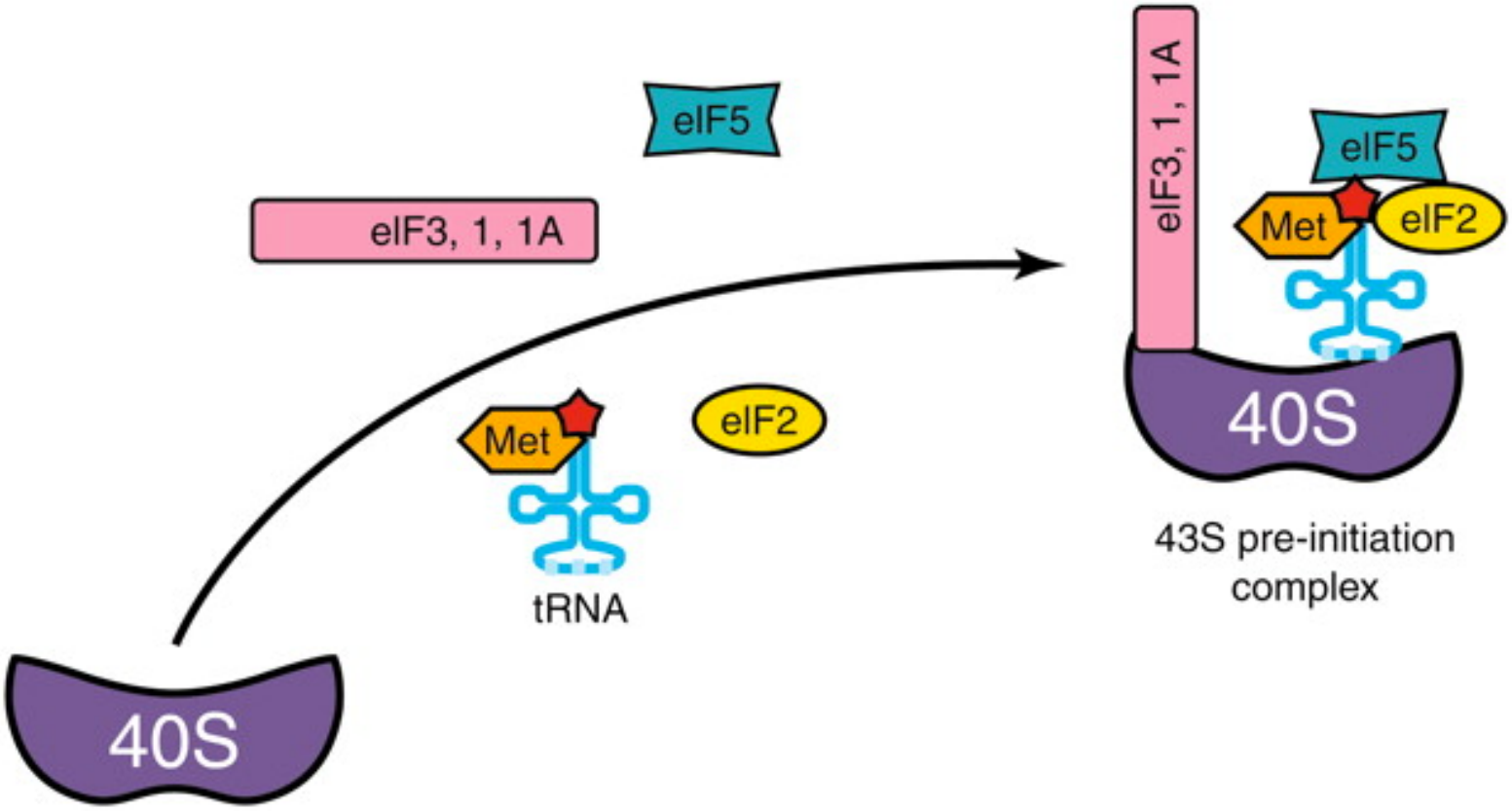
The process:

1.Initiator tRNA (Met-tRNA) gets loaded onto the small ribosomal subunit (40S).

2.Eukaryotic initiation factors (eIFs) gets loaded as well on the 40S ribosomal subunit.

3.A pre-initiation complex is formed containing (40S – Met-tRNA – eIFs).

Eukaryotic translation initiation



Eukaryotic translation initiation

Note:

Why only Met-tRNA binds to the 40S ribosomal subunit?

What about other charged tRNAs?

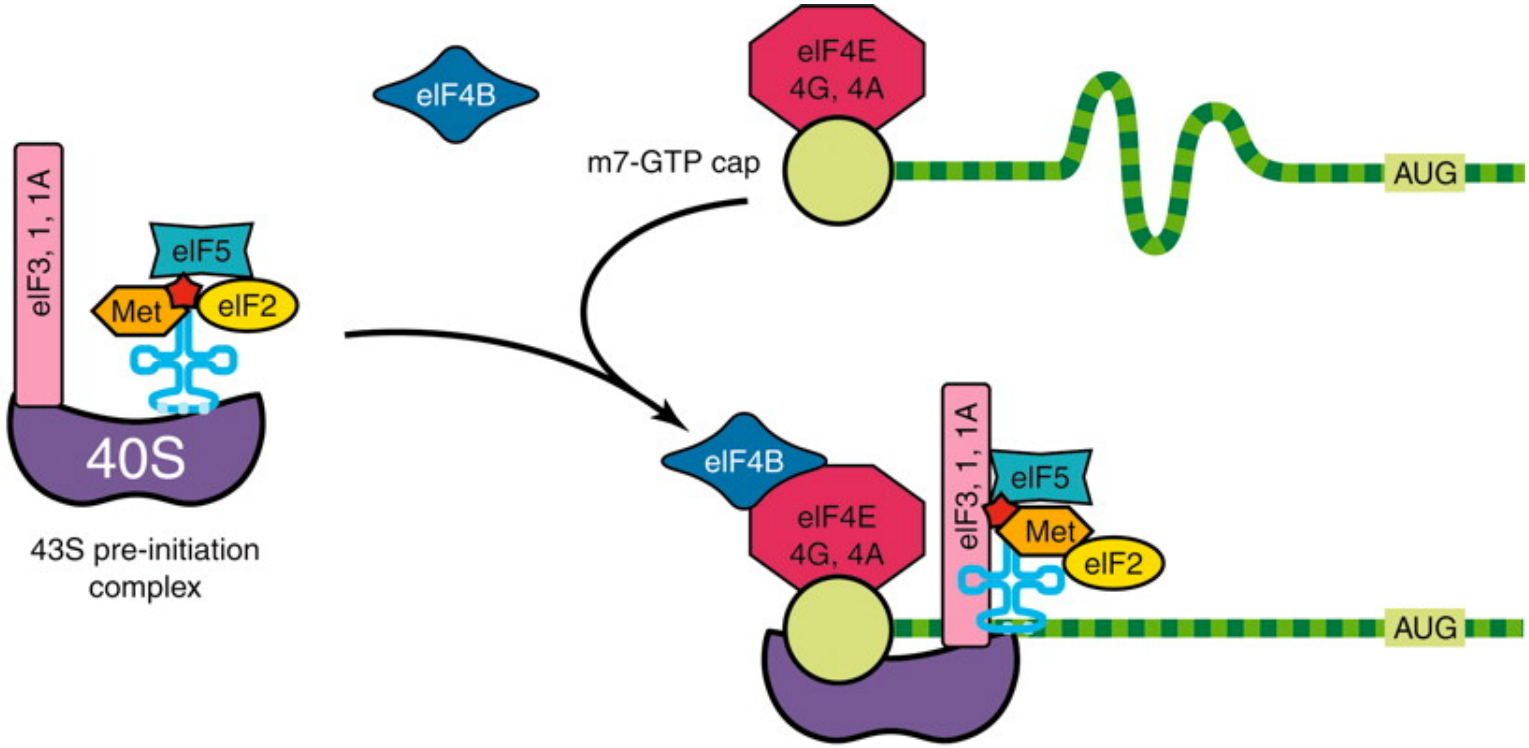
Only Met-tRNA can bind tightly to the small ribosomal subunit without the assembly of the entire ribosome.

Eukaryotic translation initiation

The process:

4.The complex (40S – Met-tRNA – eIFs) binds to the 5’ end of the mRNA (5’ Cap).

5.More eIFs are bound to the 5’ Cap.



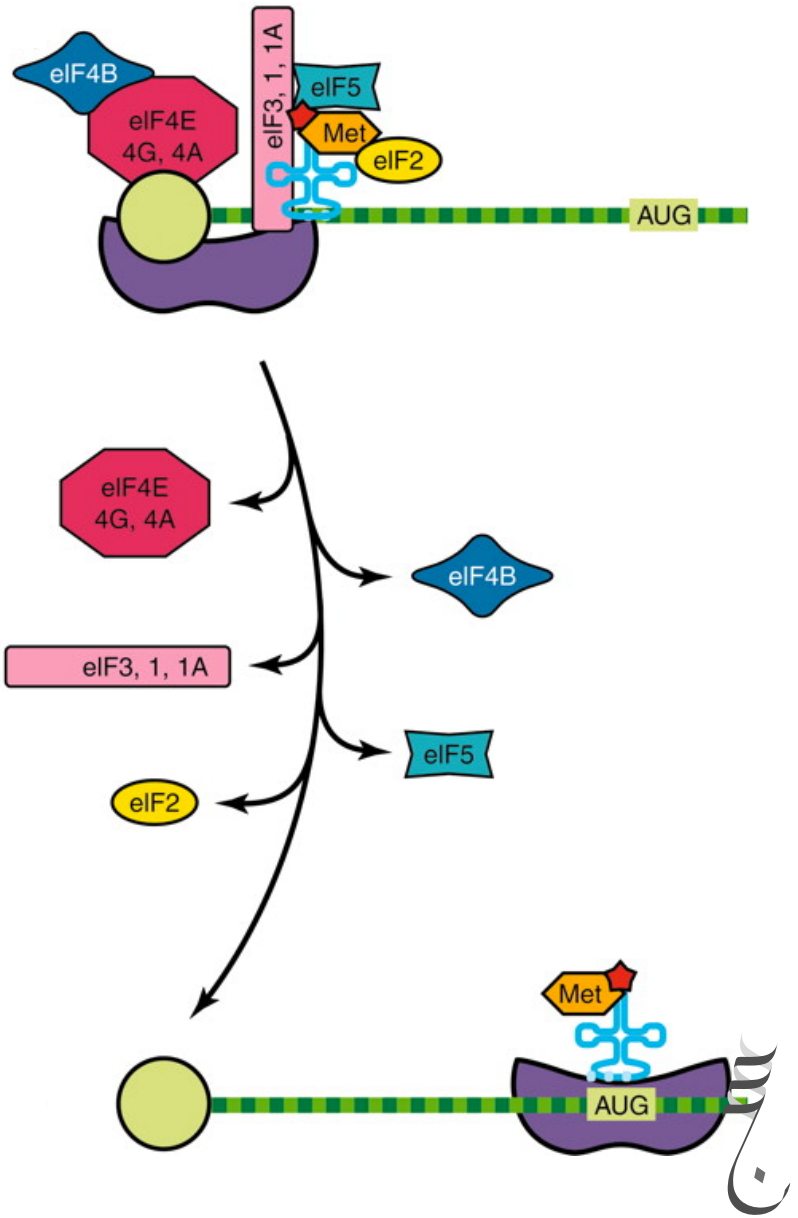
Eukaryotic translation initiation

The process:

6. The complex (40S – Met-tRNA – eIFs) moves along the transcript (5' – 3') in search for the first AUG.

7. The process is called "scanning" of mRNA.

8. When first AUG is found, eIFs dissociate.

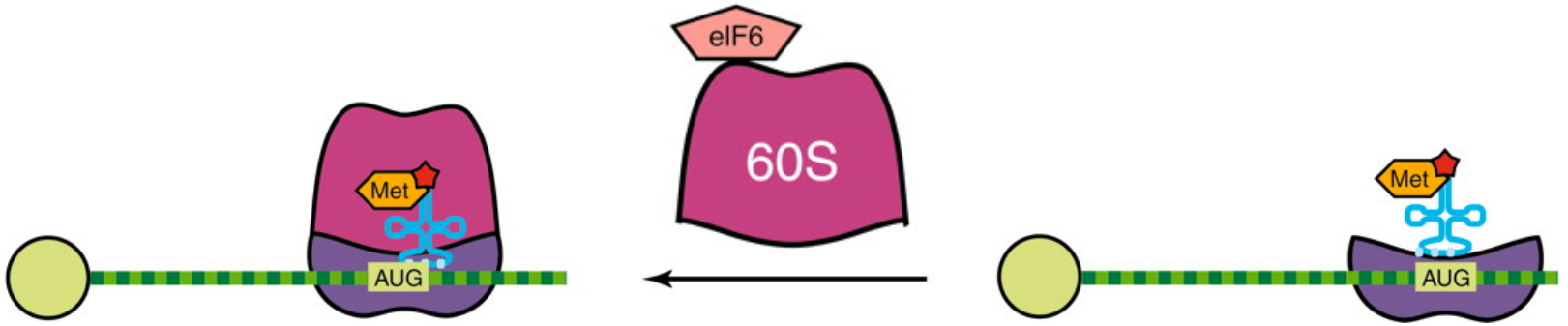


Eukaryotic translation initiation

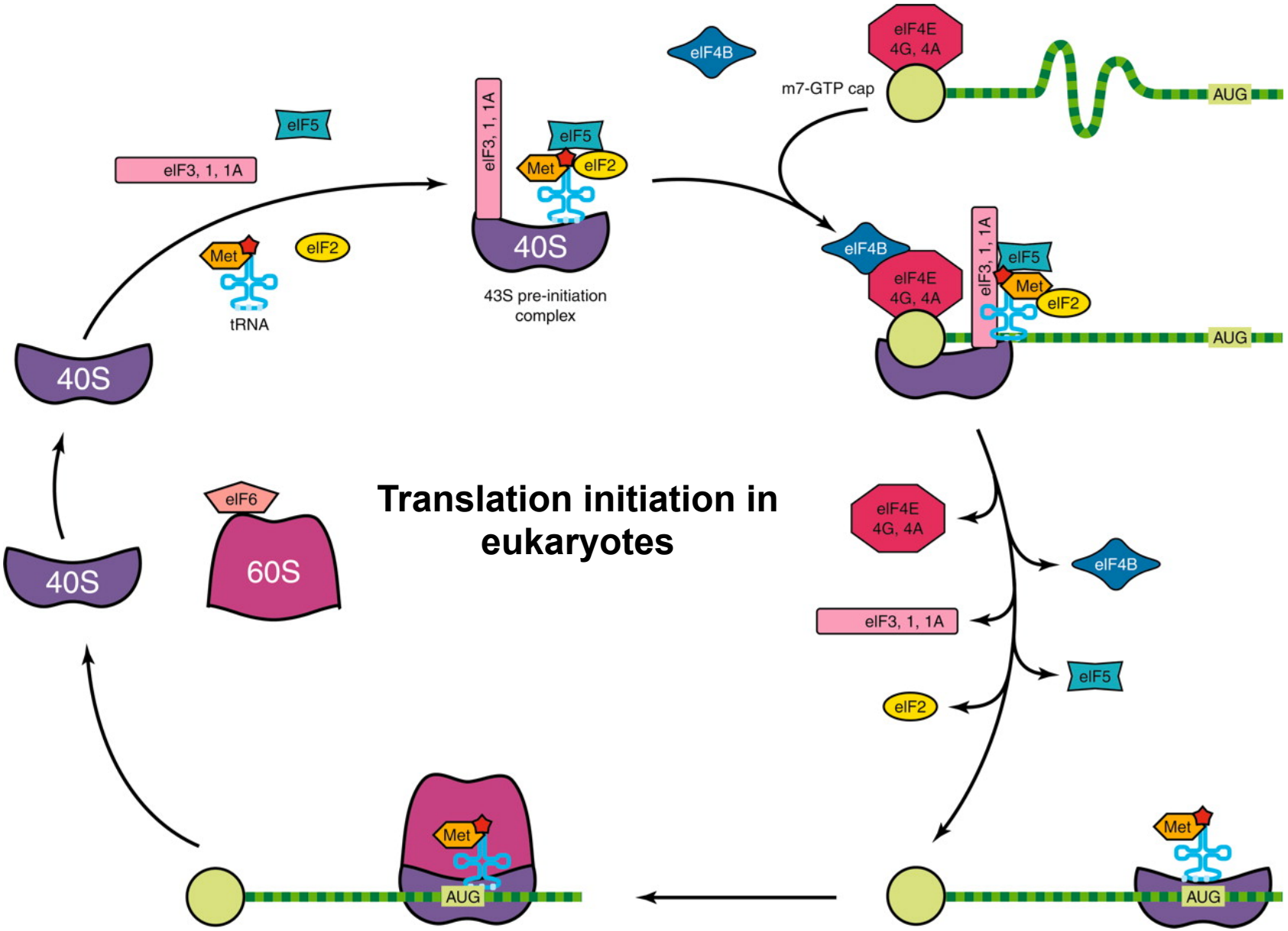
The process:

9.The large ribosomal subunit (60S) assembles to the complex at the start codon.

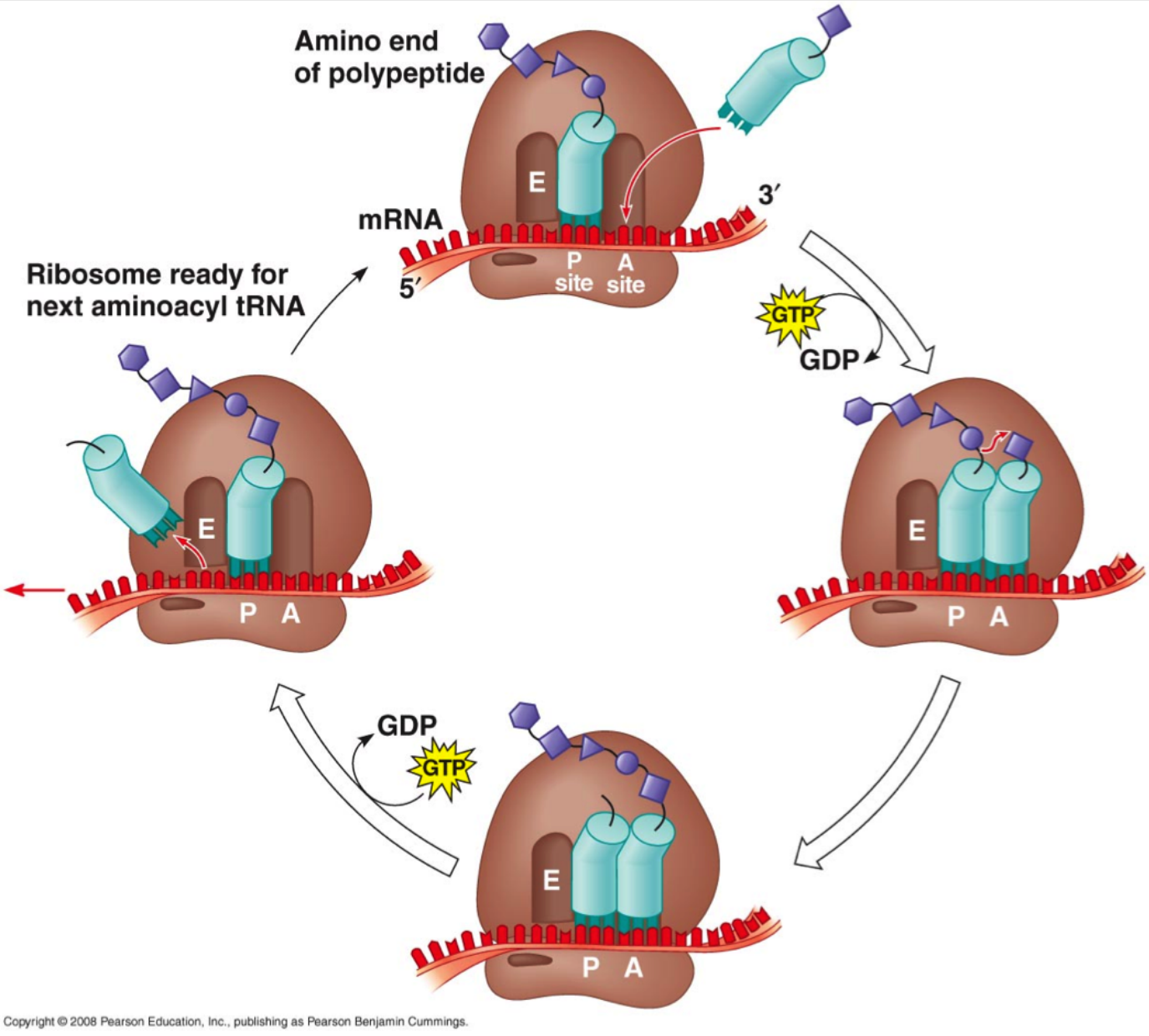
10. The initiator tRNA is positioned in the P site of the ribosome and the A site is available to receive to next charged tRNA.



Summary of initiation

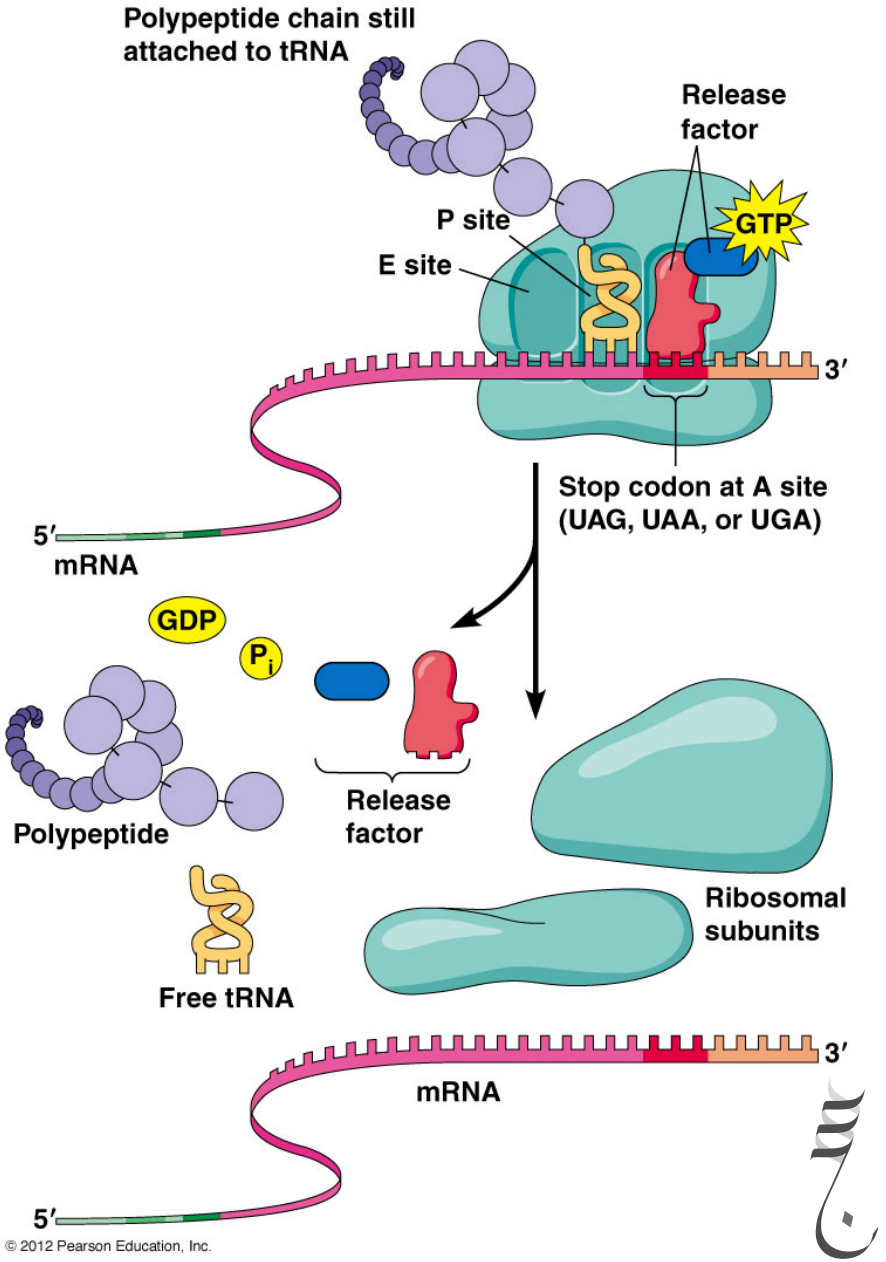


Eukaryotic translation elongation

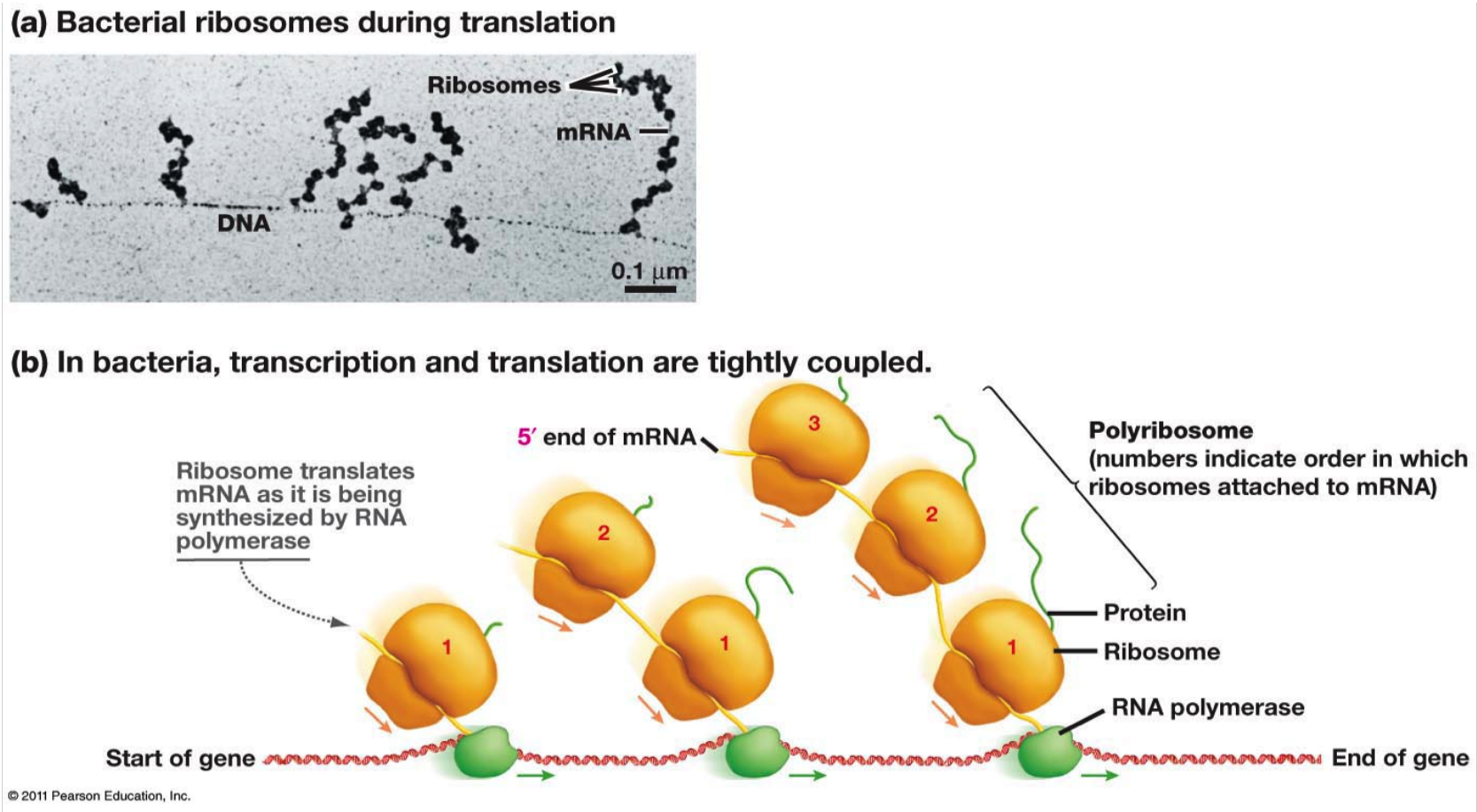


Eukaryotic translation termination

- Termination in eukaryotes is similar to that in prokaryote.
- Eukaryotic Release factor (eRF1) recognizes all stop codons.
- Other release factors help in the termination and disassembling of the ribosome.

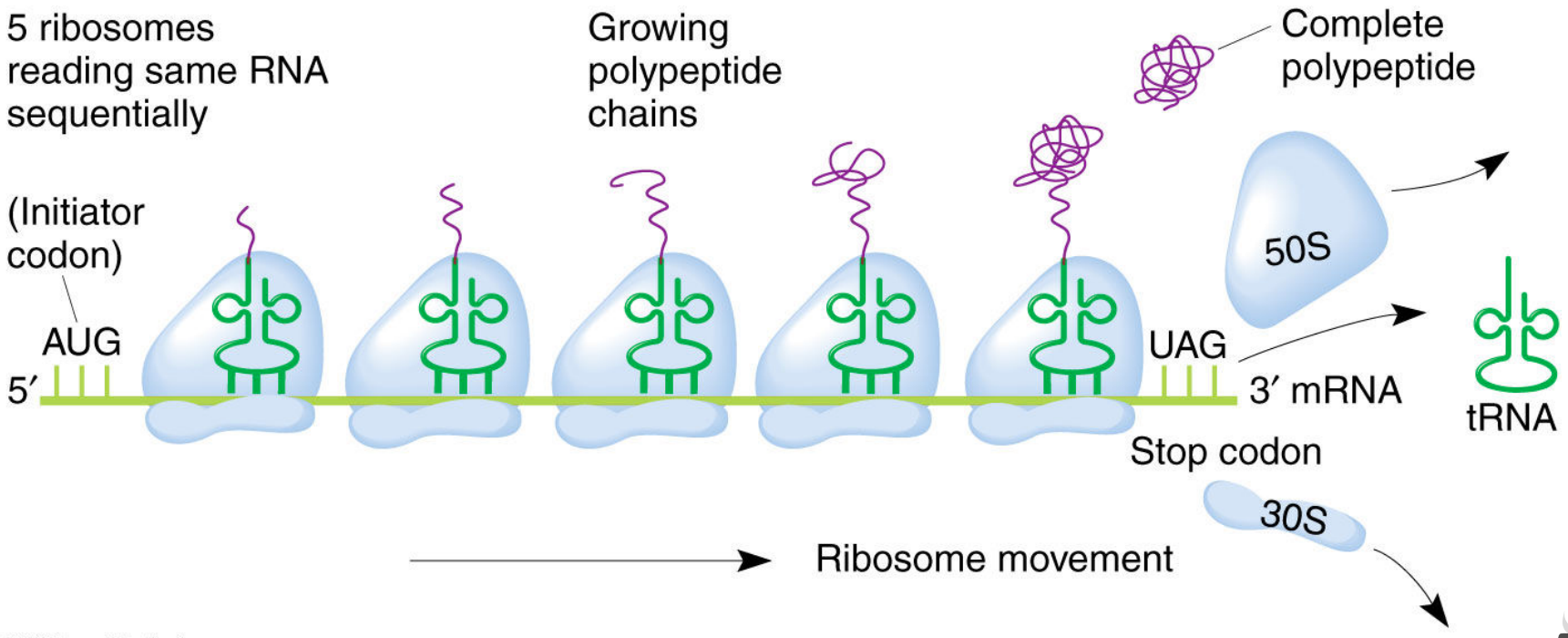


Coupled transcription translation in bacteria



Polysome

Polysome or polyribosome: a number of ribosomes translating the same transcript.



Polysome

- **Polysome or polyribosome:** a number of ribosomes translating the same transcript.
- Many rounds of translation takes place on the same transcript.

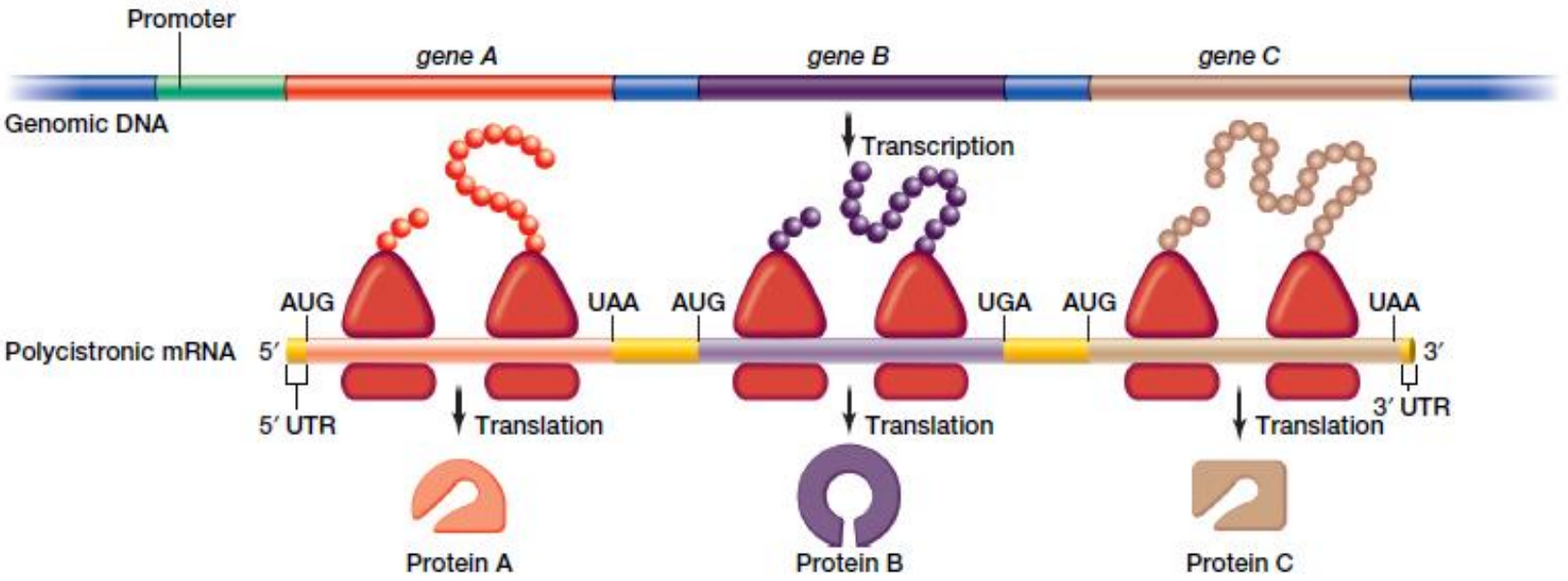
Why is this process beneficial for the cell?

- Saves time (How long)
- Quantity (How much)

Polycistronic transcript

Translating polycistronic prokaryotic transcript:

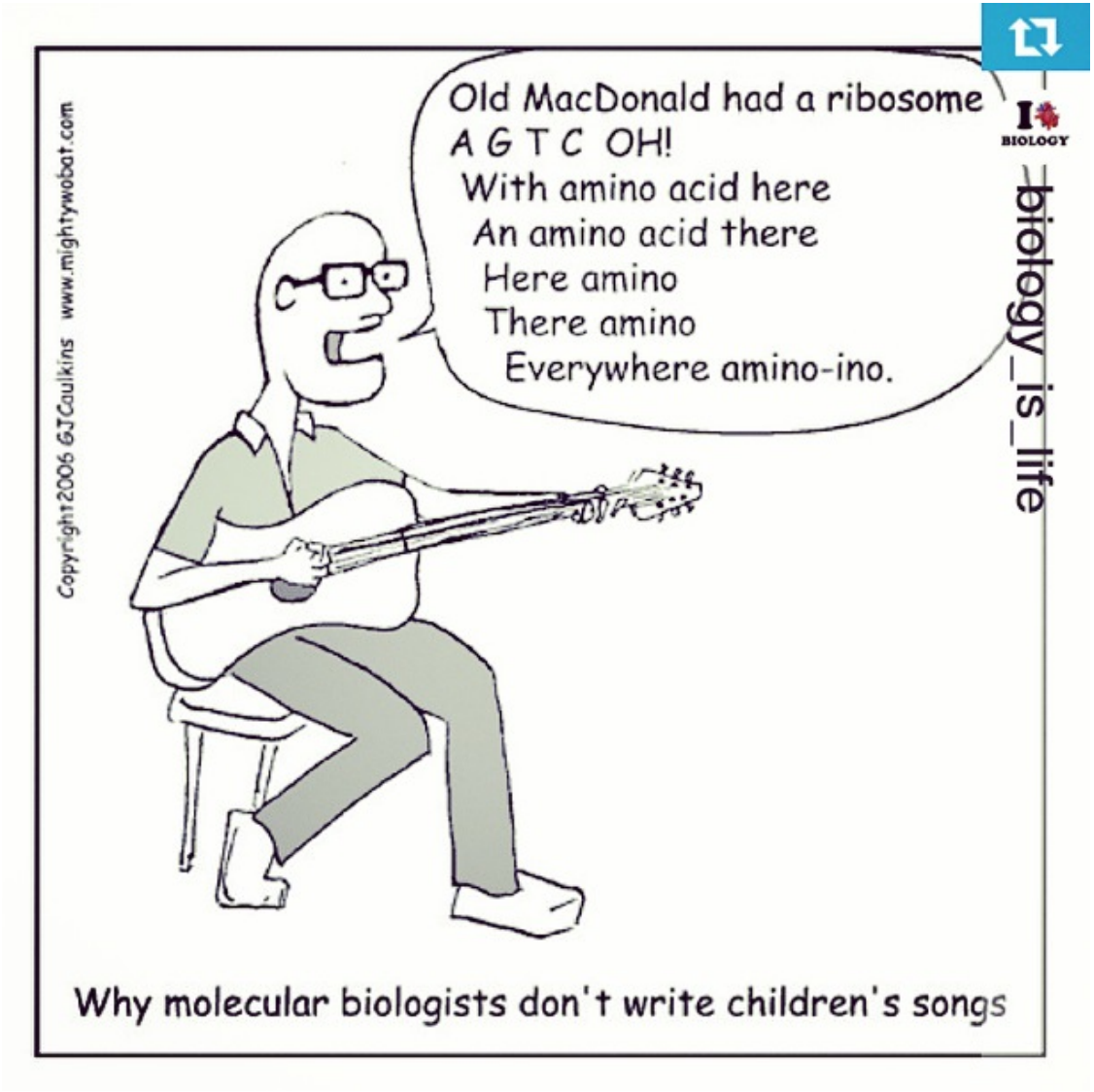
- Each gene gets translated independently because each has its own Shine-Dalgarno sequence.



Expectations

- You know how translation process occurs in eukaryotes.
- You know how ribosome finds the correct location to start translation in eukaryotes.
- You know the molecules needed in every step of translation.
- You the sequence of events in eukaryotic translation.
- You know the differences between prokaryotic and eukaryotic translation.

For a smile


Old MacDonald had a ribosome
A G T C OH!
With amino acid here
An amino acid there
Here amino
There amino
Everywhere amino-ino.
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biology_is_life
Why molecular biologists don't write children's songs