PHARM.D • YEAR 3

Advanced Pharmacology

CHAPTER 7

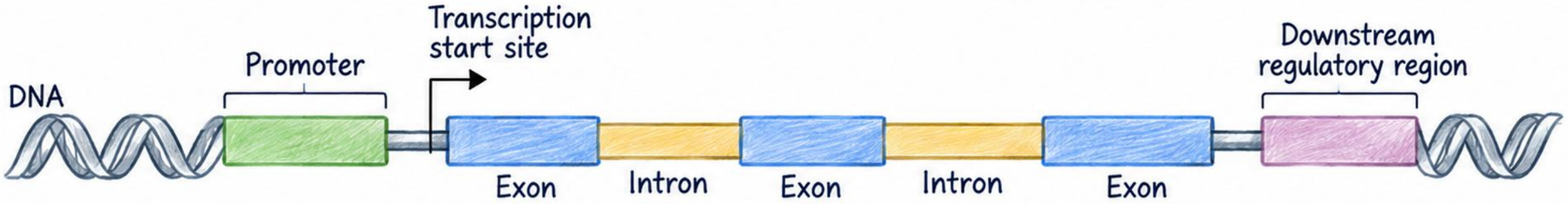
The Gene: Genome Structure and Function



PPT CHAPTER COVER

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A gene: more than a protein-coding sequence

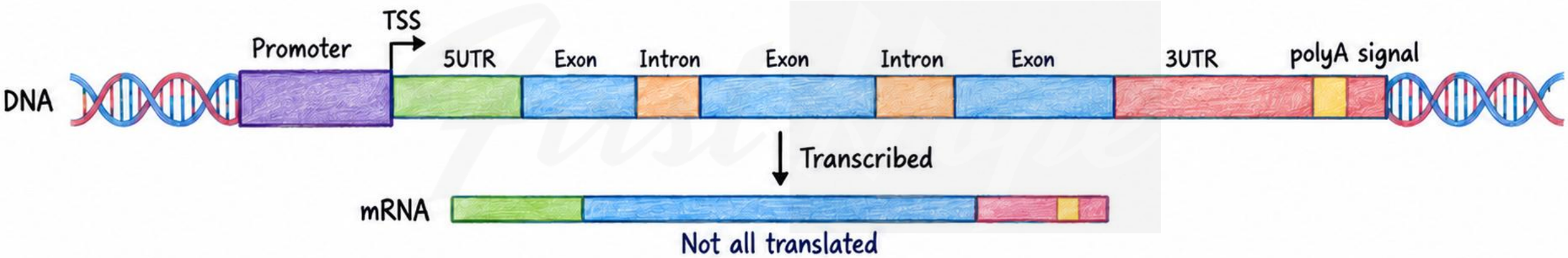


- A gene contains information for a functional product, which may be a protein or an RNA such as tRNA or rRNA.
- Its expression depends on regulatory sequences and cellular context as well as the product-encoding region.
- Promoters help recruit transcription machinery near a transcription start site.
- Eukaryotic genes commonly contain exons and introns, with surrounding regulatory information.
- A gene is therefore not identical to one uninterrupted protein-coding segment. The DNA sequence, processed transcript and translated product describe different levels of organization; some transcripts function directly as RNA and are never translated into protein.

Eukaryotic gene regions and untranslated sequences

The transcription start site marks the beginning of the RNA transcript, not necessarily the first translated codon.

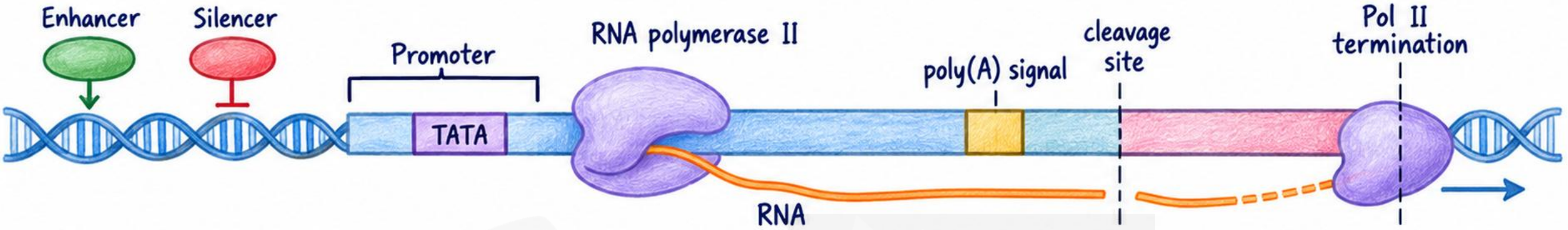
The 5-prime untranslated region lies before the coding sequence, and the 3-prime untranslated region follows it.



Both UTRs are transcribed but do not normally encode the main protein sequence.
Introns are removed during splicing; exons remain in the mature transcript.

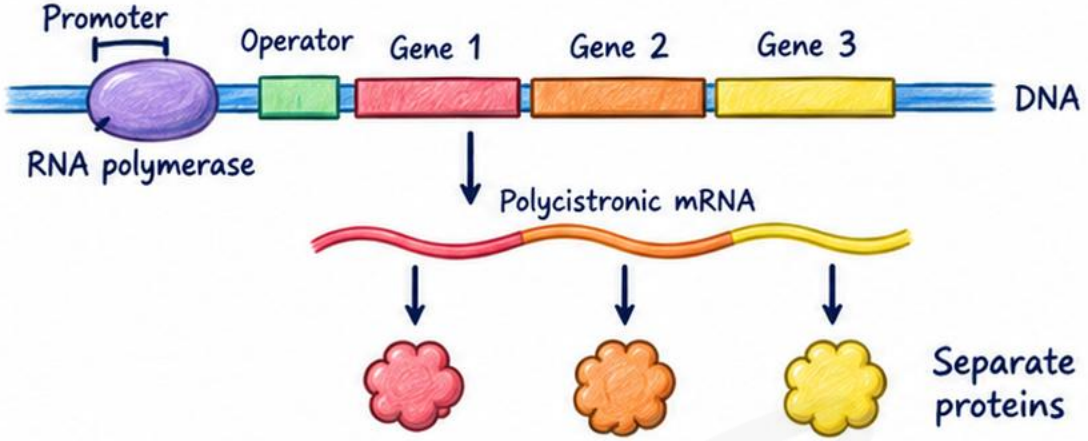
Exons can contain UTR sequence as well as coding sequence, so exon does not mean entirely protein-coding.
UTRs influence stability, localization and translation. Alternative transcription starts or processing can produce different transcripts from the same genomic region.

Promoters, RNA cleavage and termination



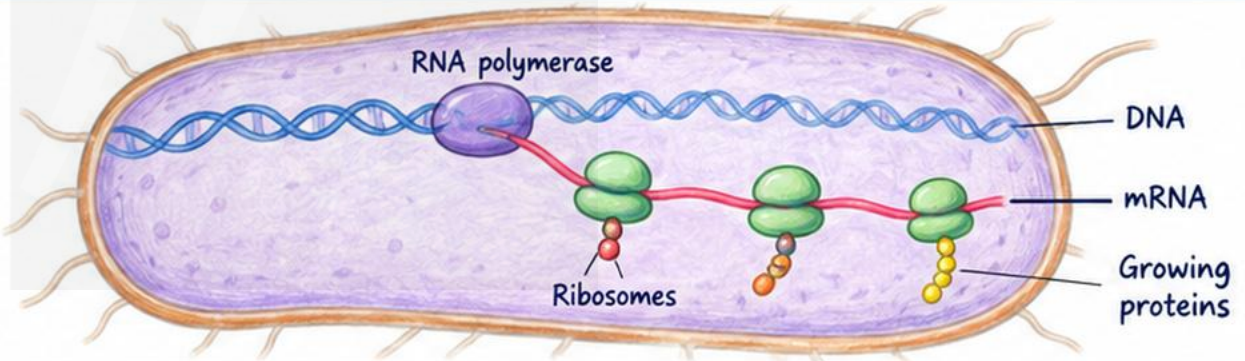
- Promoters provide binding sites that help position transcription machinery and regulate initiation.
- A TATA box occurs in some promoters but is not present in every eukaryotic gene.
- Enhancers and silencers influence expression through transcription factors and chromatin organization.
- For many RNA polymerase II transcripts, a polyadenylation signal directs cleavage and tail addition.
- The RNA cleavage site and polymerase termination site are distinct; transcription commonly continues beyond the cleavage region before termination. Regulatory elements and RNA-processing signals have different roles even when both affect gene output.

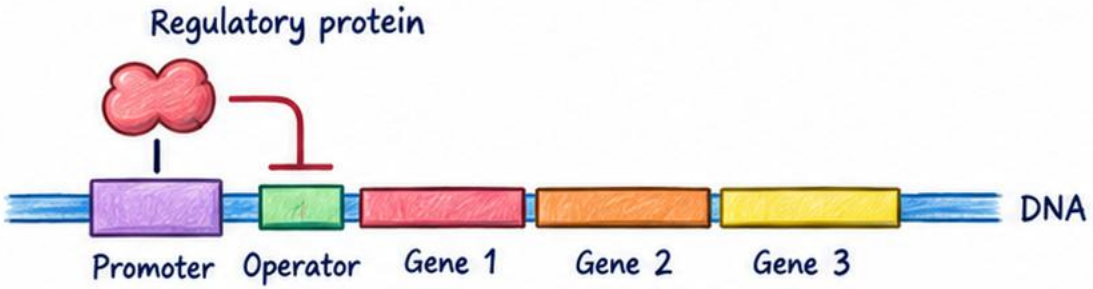
Bacterial genes and operon organization



- Many bacterial protein-coding genes are continuous and can be arranged in operons under shared regulatory control.
- An operon can produce a polycistronic RNA containing several coding regions, coordinating related functions.

- Because bacteria lack a nuclear envelope, transcription and translation can occur in overlapping time and space.





- Promoters, operators and regulatory proteins determine expression responses.
- Most bacterial mRNAs do not undergo the same processing as typical eukaryotic pre-mRNAs, but bacterial tRNA and rRNA are extensively processed. Post-translational modifications also occur in bacteria. Simpler compartmentation does not mean that bacterial expression is completely unregulated or modification-free.

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