Molecular Biology 3

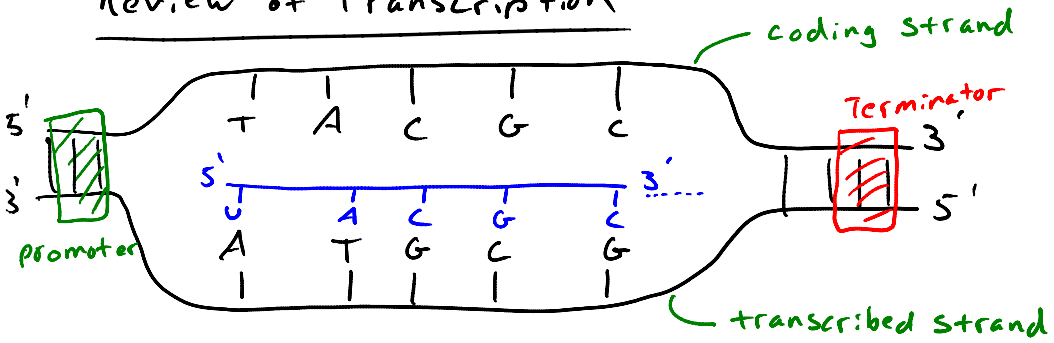
- iClicker 24A
- Translation
  - Codons
  - Genetic Code
  - Example
- iClicker 24B

Final Exam
Dec. 16th
11:30 - 2:30
(wed.)

Office Hours Today
2-3

- Due in Lab next week
  - Pre-lab 9
    Lab report 8
- Exam 2
  - Last name A-E in McCormick Cafe
  - Last name F-Z in Lipke

Review of Transcription



Notes: not all DNA is transcribed
- there are spaces between genes, promoters, terminators

Gene Regulation

genes can be turned "on" or "off" by controlling transcription

if no mRNA → no protein

Translation — making protein based on mRNA sequence

mRNA	→	protein
4 nt. A, U, C, G		20 a.a.
5' → 3'		N → C

we read mRNA in groups ("words") of nucleotides

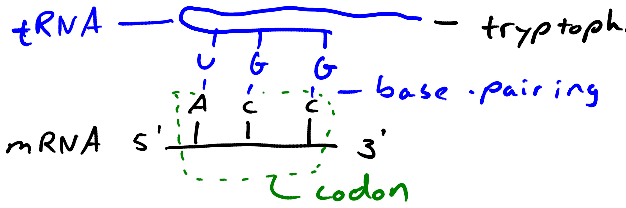
groups = codons

each codon = 3 nucleotides → 64 possible combinations

tRNA

transfer RNA → 64 different tRNA's

- each tRNA is specific to one amino acid



- tRNA reads start and stop codons

Making Protein

① ribosomes start at the start codon closest to 5' end of mRNA

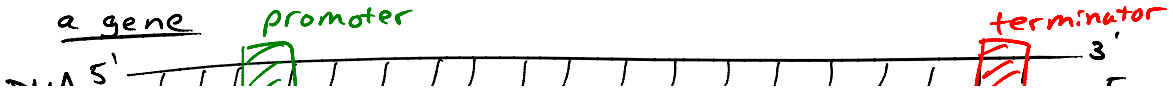
repeats:

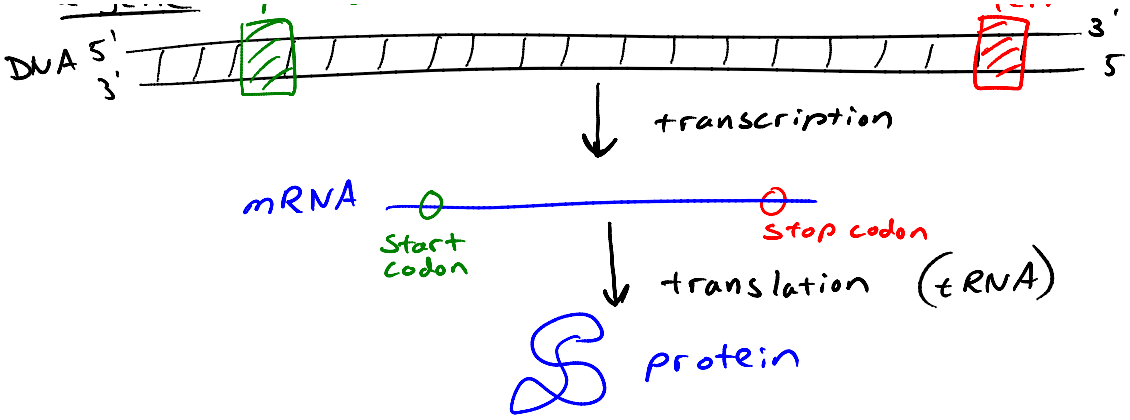
② tRNA with a specific amino acid base-pairs to mRNA

③ amino acid is added to forming protein and ribosome moves 3 nucleotides ahead

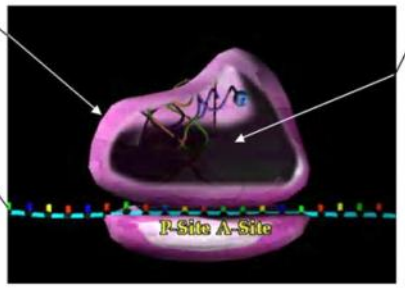
④ at stop codon, mRNA and protein are released

⑤ protein folds as it is being made





• done by **ribosome** (complex of many proteins and rRNA)



mRNA is read 5′ to 3′

The ribosome has two places for tRNA to bind.
• one holds the tRNA with the next amino acids to be added
• the other holds the tRNA with the growing protein on it.

• The process continues until the stop codon is reached & then the protein is released.

Q: Which codons correspond to which amino acids?
A: See the table of the Genetic code below:
(this is essentially univerasal for all life on earth)

U U U → phe.

The Genetic Code

	U	C	A	G	
U	UUU phe	UCU ser	UAU tyr	UGU cys	U
	UUC phe	UCC ser	UAC tyr	UGC cys	C
	UUA leu	UCA ser	UAA STOP	UGA STOP	A
	UUG leu	UCG ser	UAG STOP	UGG trp	G
C	CUU leu	CCU pro	CAU his	CGU arg	U
	CUC leu	CCC pro	CAC his	CGC arg	C
	CUA leu	CCA pro	CAA gln	CGA arg	A
	CUG leu	CCG pro	CAG gln	CGG arg	G
A	AUU ile	ACU thr	AAU asn	AGU ser	U
	AUC ile	ACC thr	AAC asn	AGC ser	C
	AUA ile	ACA thr	AAA lys	AGA arg	A
	AUG met*	ACG thr	AAG lys	AGG arg	G
G	GUU val	GCU ala	GAU asp	GGU gly	U
	GUC val	GCC ala	GAC asp	GGC gly	C
	GUA val	GCA ala	GAA glu	GGA gly	A
	GUG val	GCG ala	GAG glu	GGG gly	G

1st → U 2nd

stop codons

some only have one codon

① redundant

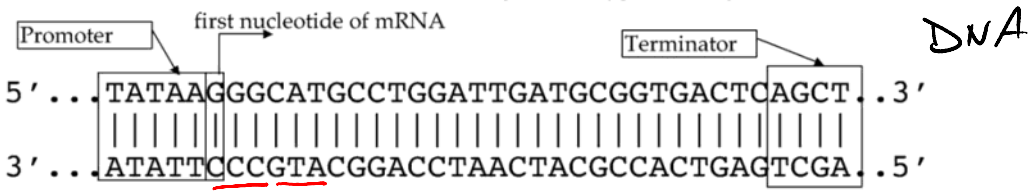
start codon

* START CODON

stop codons → end translation
no amino acid is added

Putting it together, a sample problem:

Here is a small section of a chromosome containing a small hypothetical gene.

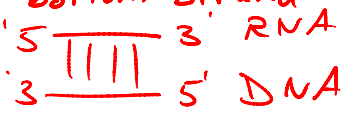


Given that info, which is the mRNA produced by this gene?

a) 5'-GGGCAUGCCUGGAUUGAUGCGGUGACUC-3' → mRNA

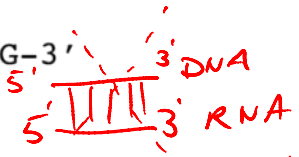
base pairs with bottom strand

or:



b) 5'-CCCGUACGGACCUAACUACGCCACUGAG-3'

would have to base pair w/ top strand



→ not anti-parallel

What is the amino acid sequence of the resulting protein?

Translation — start codon — stop codon

5'-GGGCAUGCCUGGAUUGAUGCGGUGACUC-3'

met – pro – gly – leu – met – arg

sets 3 codons is called "frame"