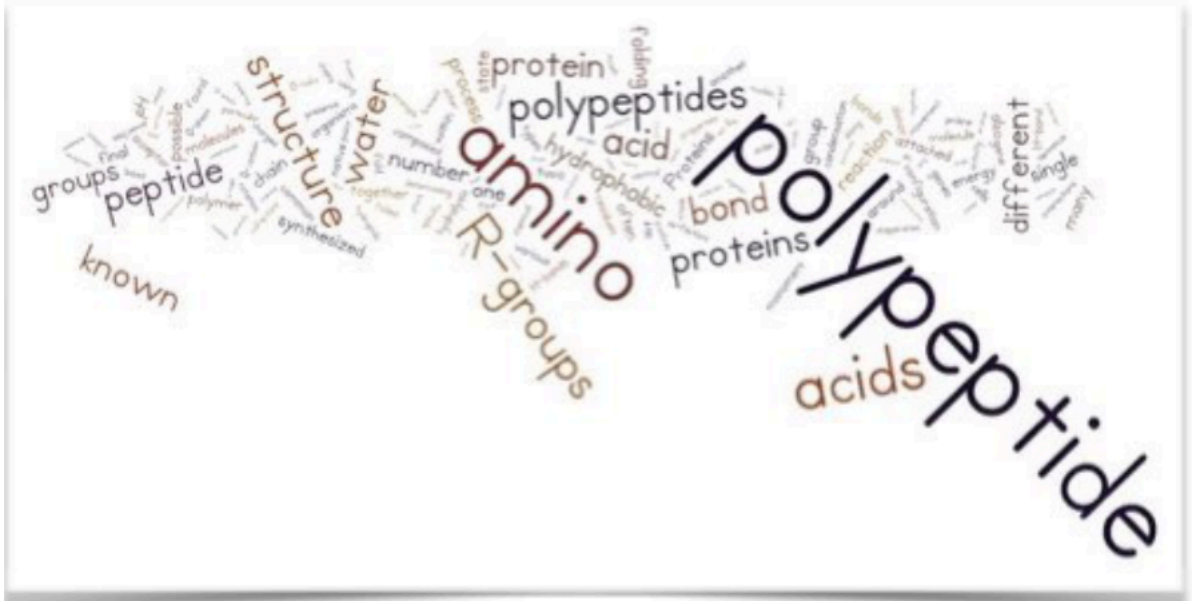
chapter 8 part 1 - any questions



chapter 8 part 2 pages 181-189

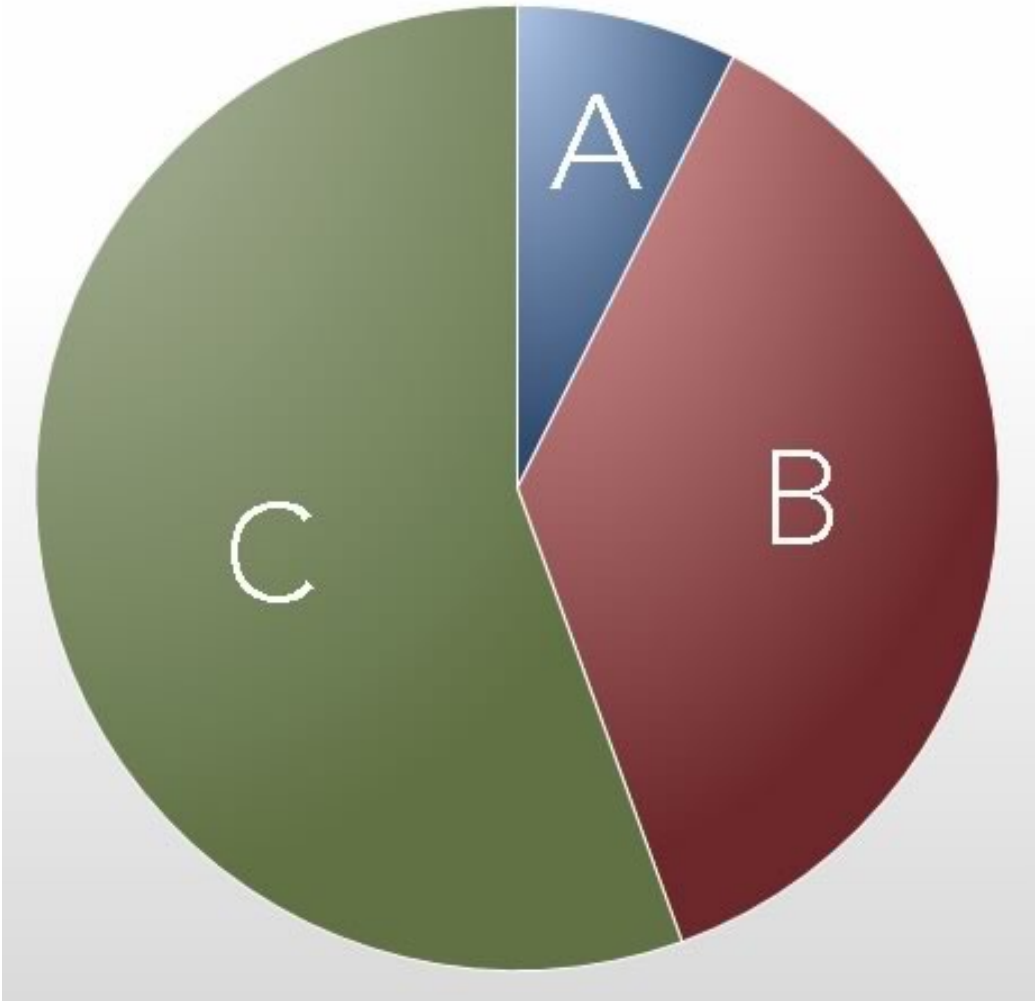
check course web site for midterm information

review sessions on Wednesday and Friday afternoons

25: read 181-187 Below, draw and label the steps involved in the first stage of gene expression, that is, the synthesis of mRNA.

To generate an mRNA from a gene, which is NOT needed?

- a transcription start sequence in the DNA
- a signal to end RNA synthesis (within the DNA)
- a stop codon in the RNA
- no idea



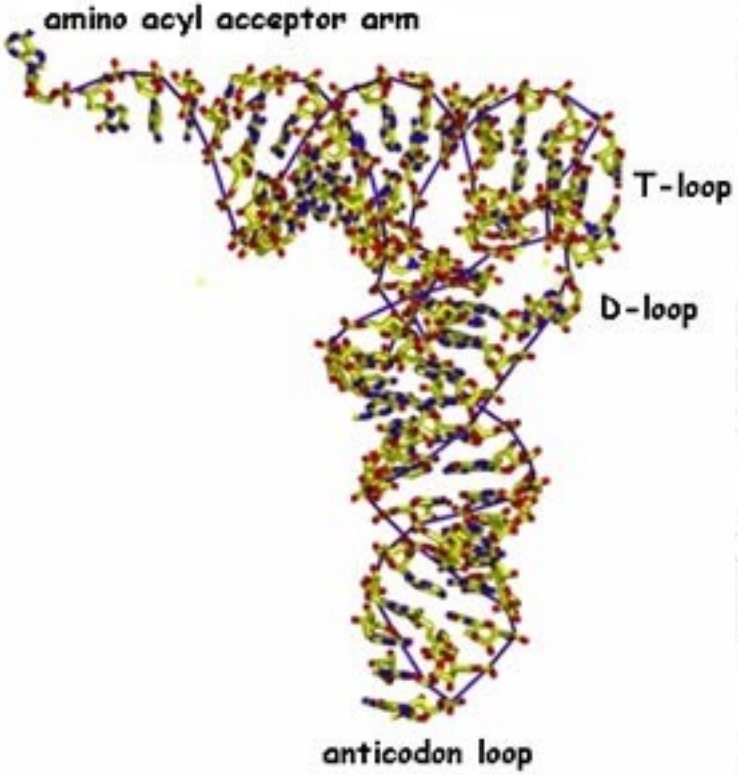
GROUP (make a list): What decisions have to be made to determine where and when a gene is transcribed (that is, RNA is synthesized) and which part of that RNA is translated?

You now have an mRNA that is present in cytoplasm. Draw the mRNA and indicate how the ribosome decides where to begin and where to end translation of the encoded polypeptide.

Is it random or is there a signal, how is signal recognized?

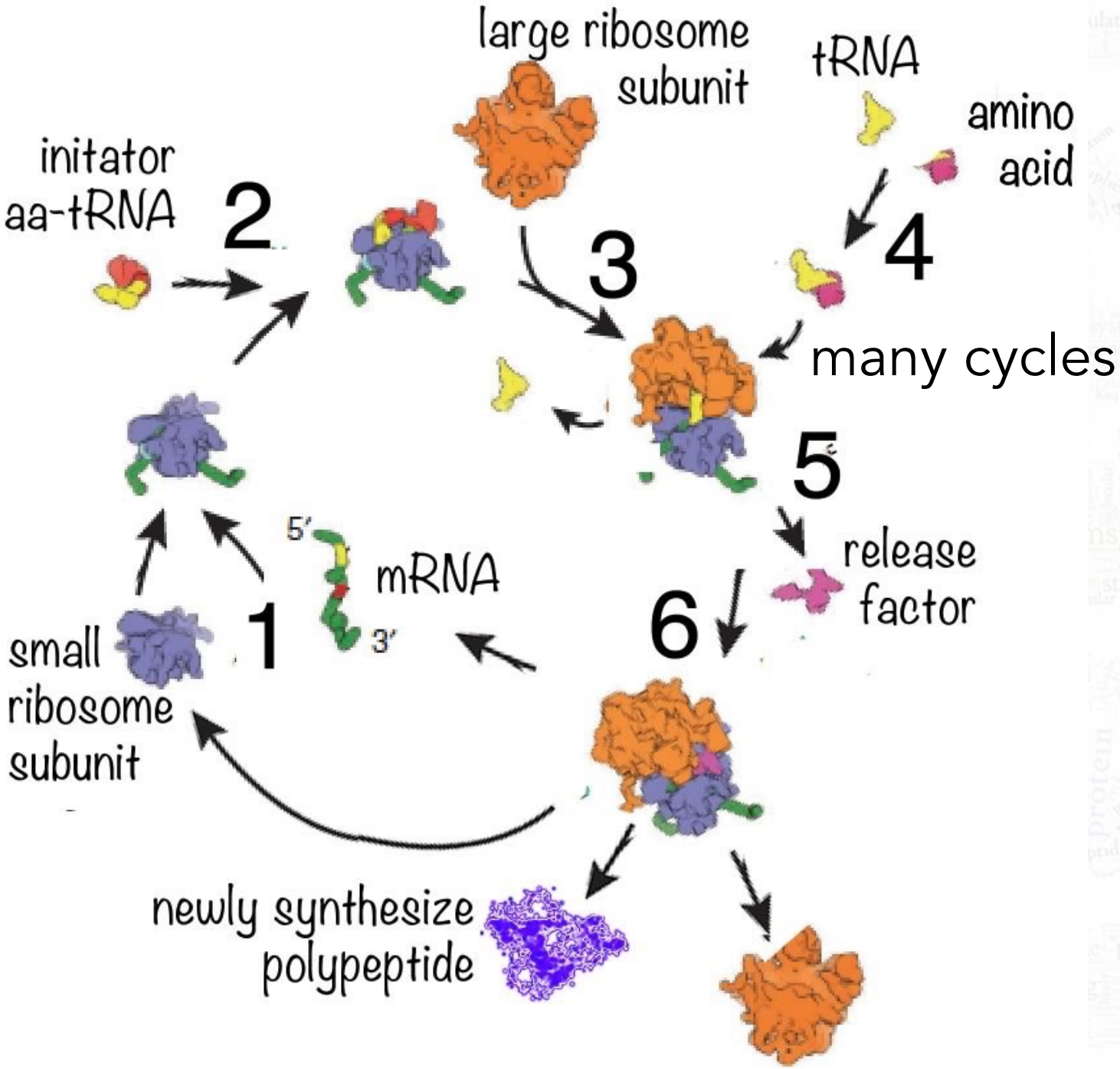
How is sequence in DNA/RNA translated into a sequence of amino acids?

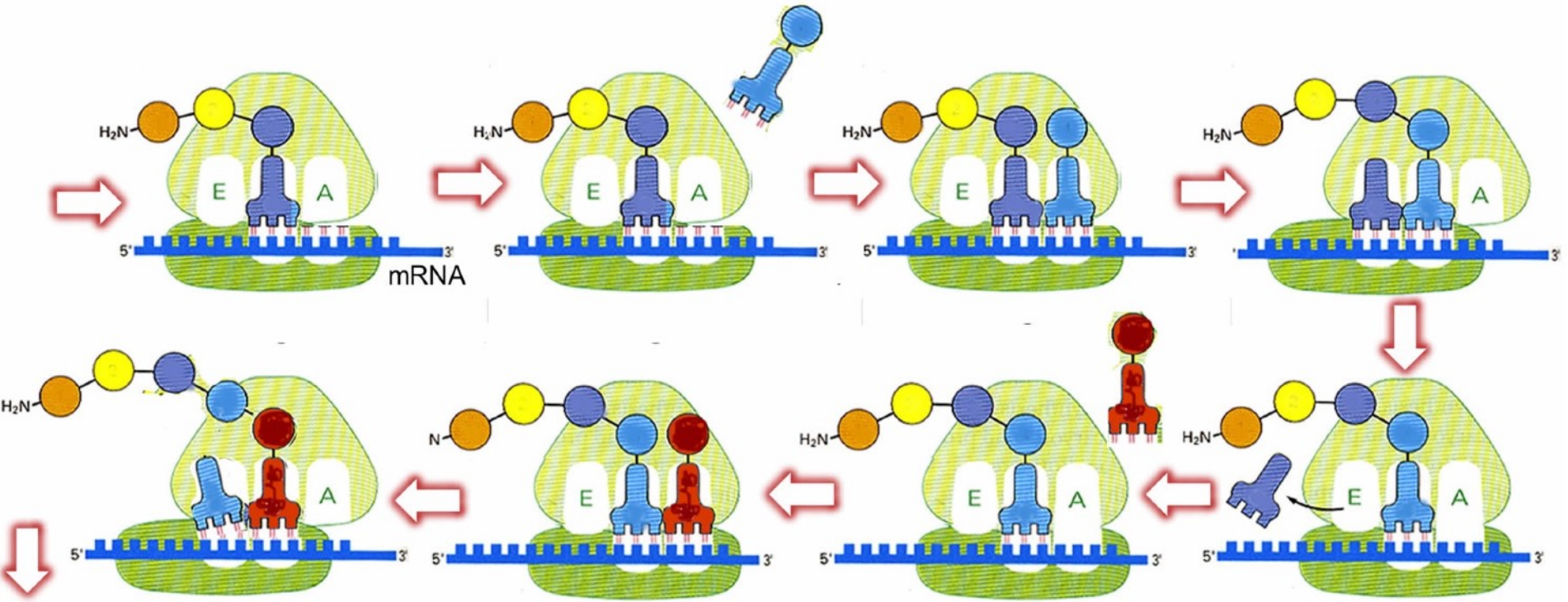
All components of the ribosome system (RNA and polypeptides) - encoded in DNA



tRNA - encoded in DNA

amino acyl tRNA synthase
- encoded in DNA
recognizes anti-codon + acceptor

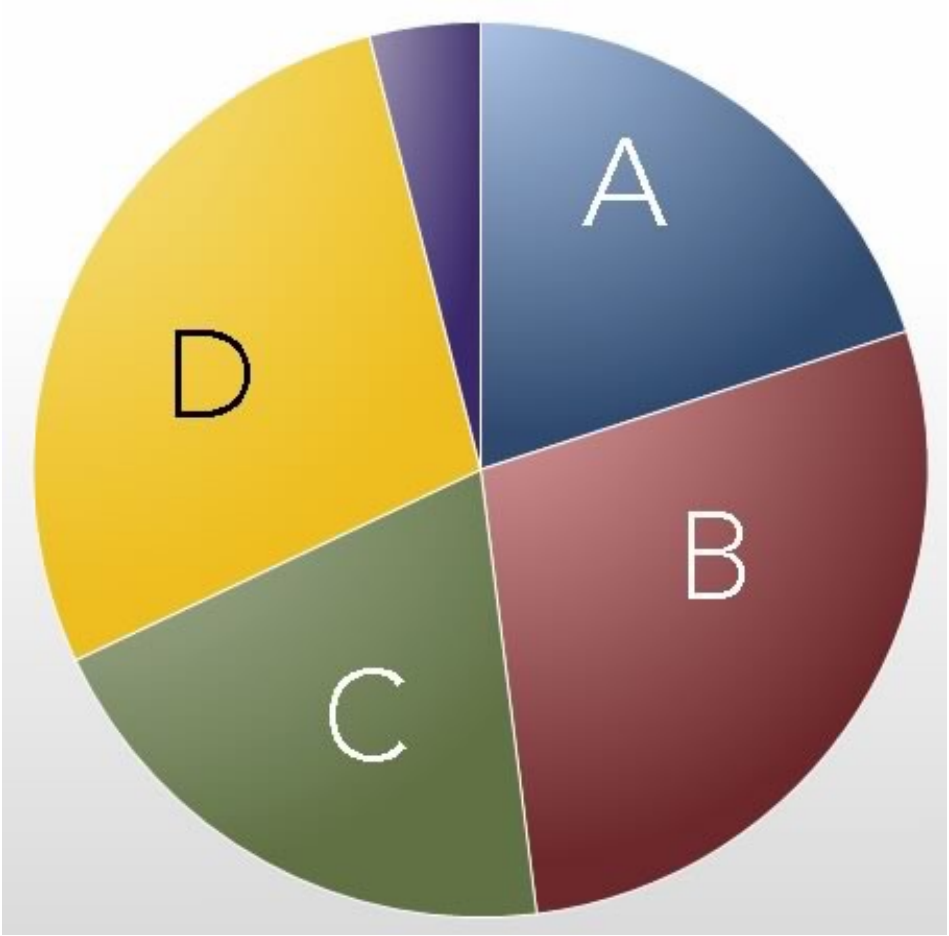

large ribosome subunit
tRNA
amino acid
initator aa-tRNA
2
3
4
many cycles
5
release factor
6
5′
mRNA
3′
1
small ribosome subunit
newly synthesize polypeptide


H2N
E
A
5'
3'
mRNA
N

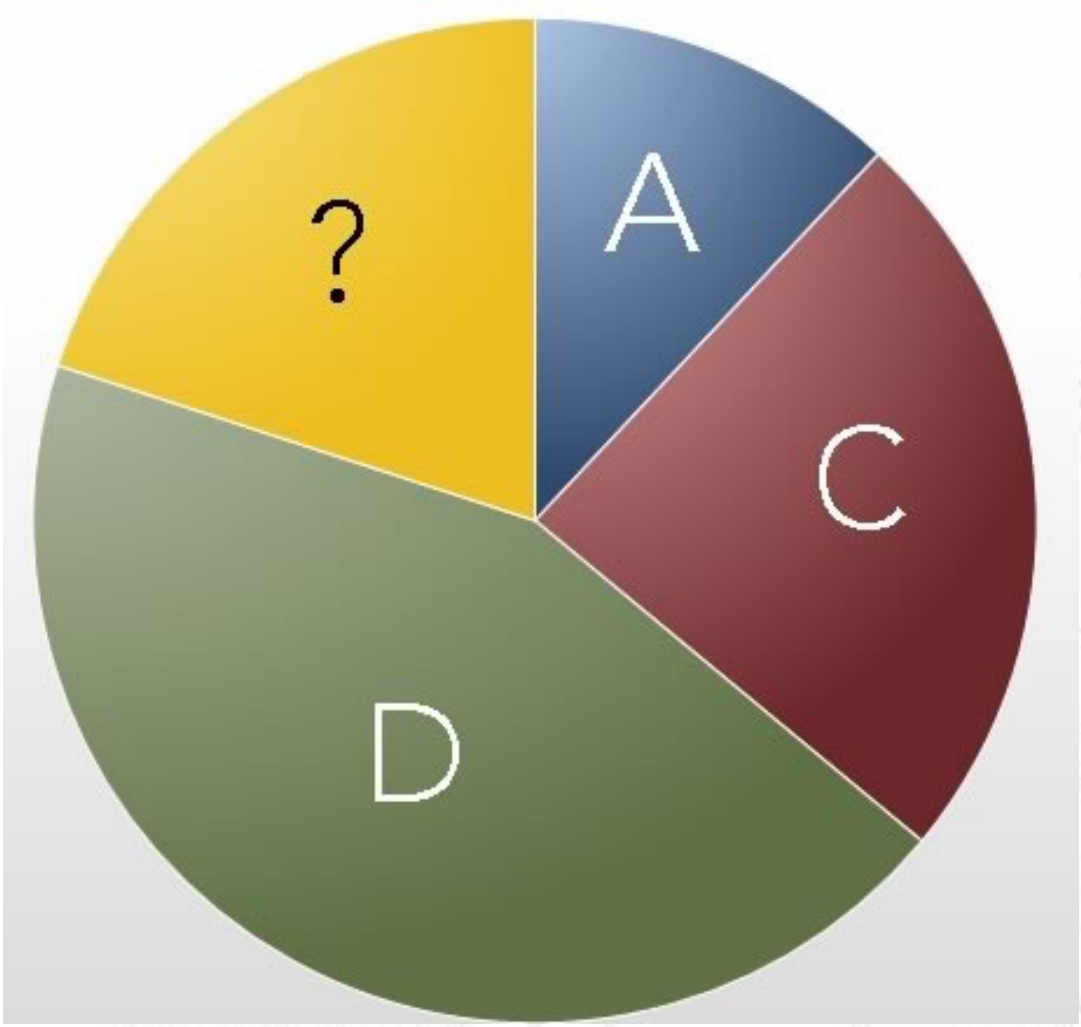
To generate a full length polypeptide of wild type length from an mRNA, which is not needed?

should have been ARE

- a transcription start sequence
- a stop codon
- a start codon near the 5' end of the RNA
- a promoter or enhancer sequence
- no idea



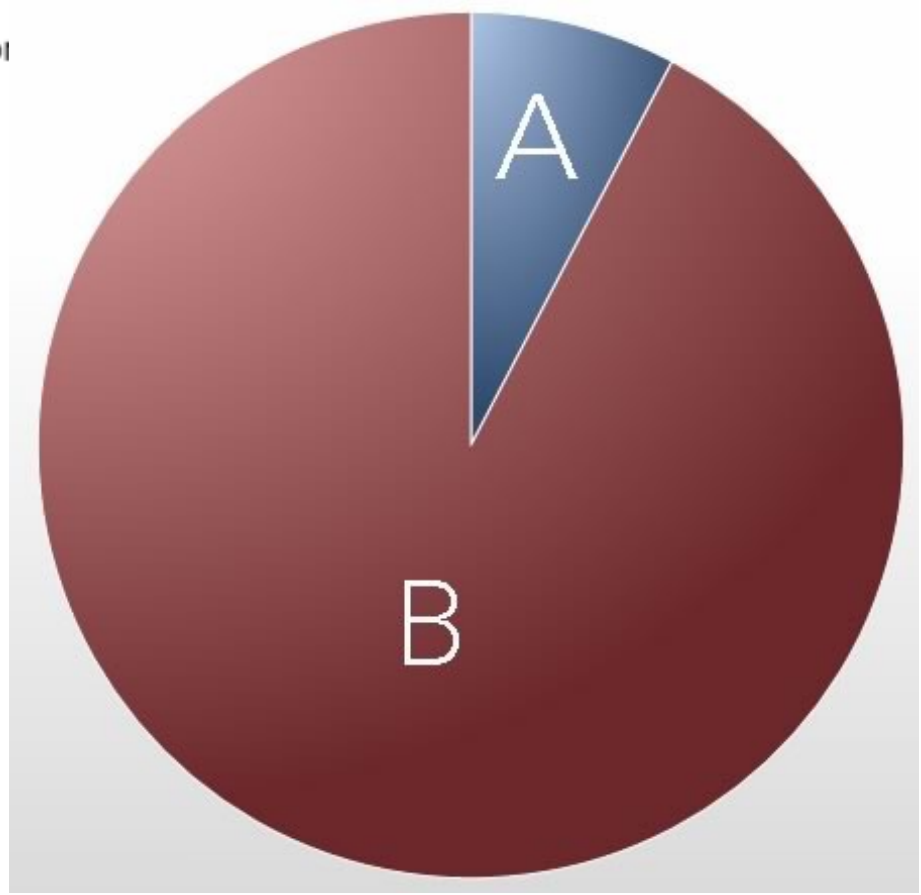
Which would be the best (rough) estimate for the average number of collisions between amino-acyl-tRNAs and an mRNA-ribosome complex before the "right" aa-tRNA binds?

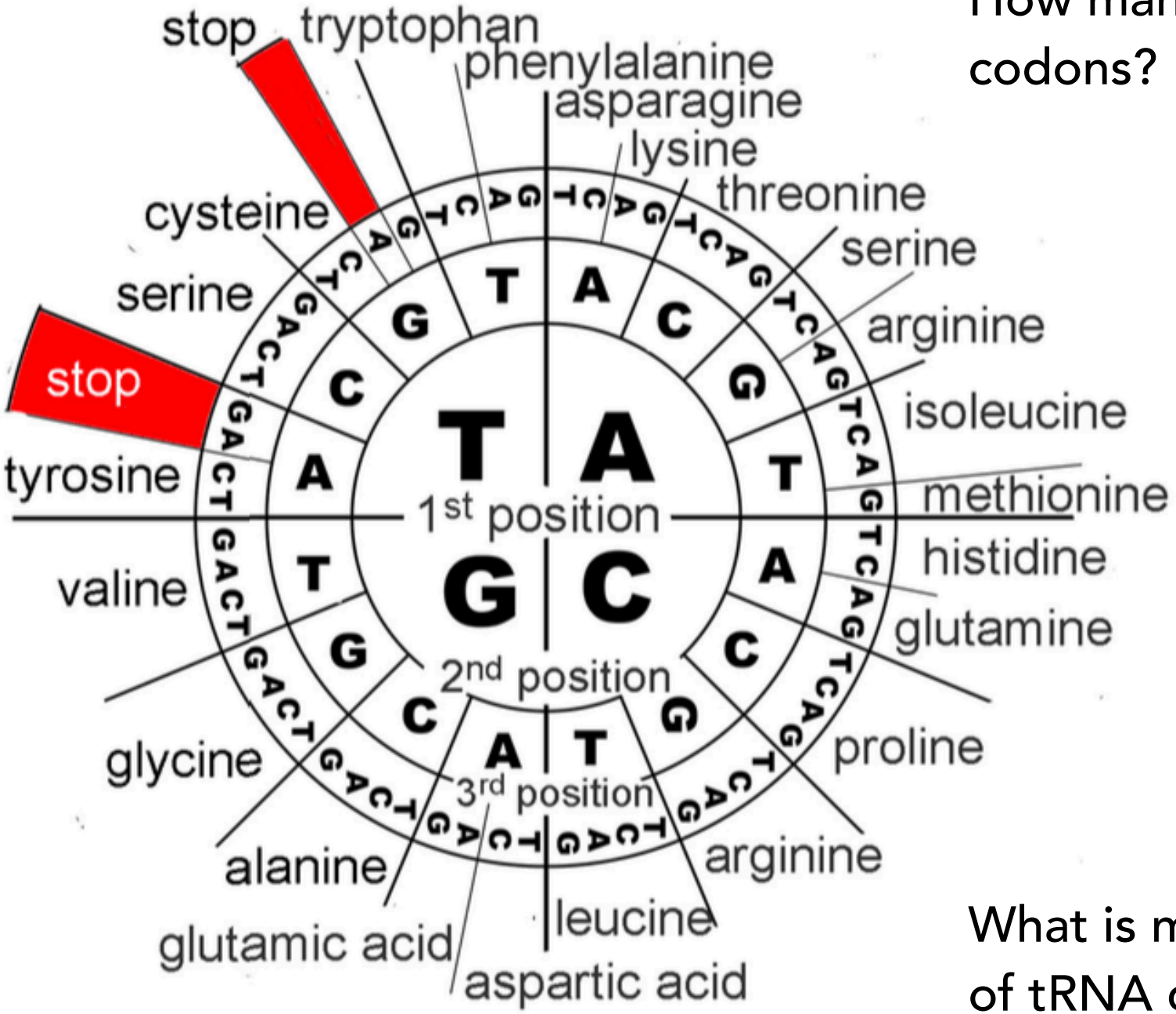


- A. 1
- B. 4
- C. 20
- D. impossible to calculate
- no idea

Why is the genetic code considered redundant?

- there is only a single stop codon
- each codon encodes a unique amino acid.
- multiple codons encode the same amino acid
- an mRNA can have multiple start codo
- no idea

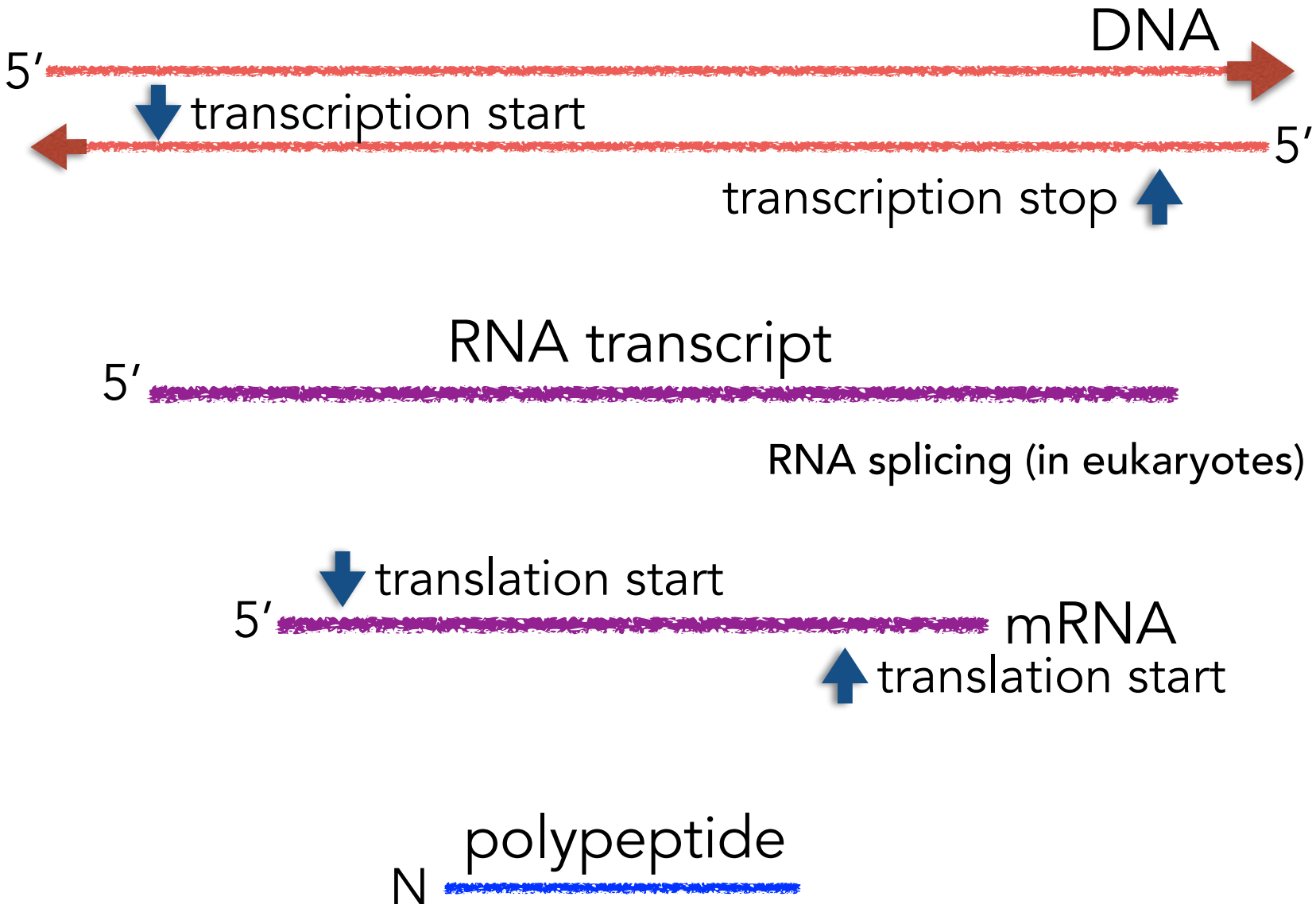




How many distinct codons?

What is max. number of tRNA genes?

Transcription and translation summary



RNA transcript

Other factors regulate translation of RNA and its stability (half-life): endo-/exo-nucleases)

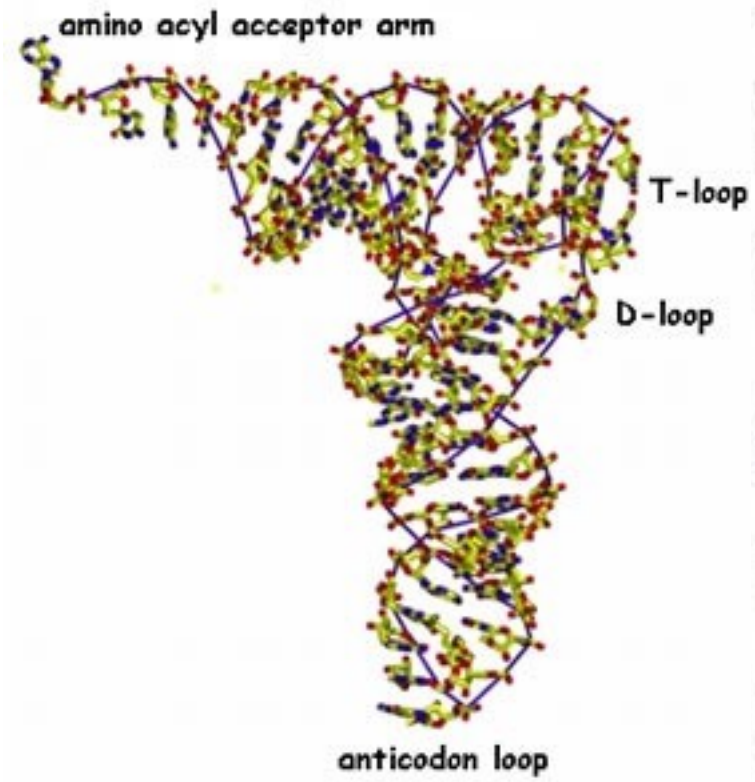
e.g. Is the 5’ end of mRNA visible to ribosome?

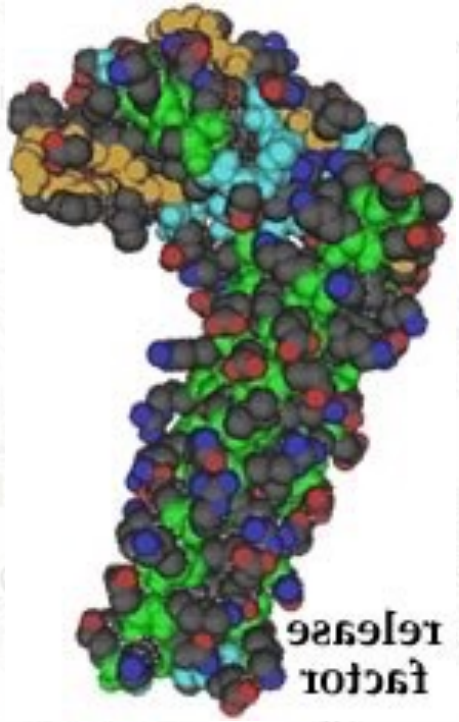
Similar factors/signals regulate polypeptide stability.

Questions to answer:

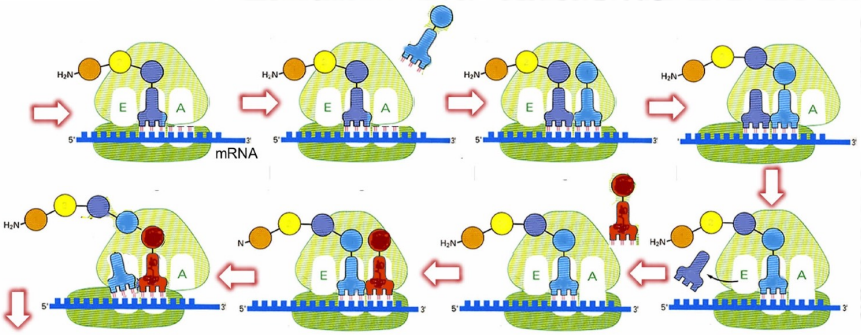
- **Why so many tRNA genes?** How, in the most basic terms, do different tRNAs differ from one another?
- How might the **concentration of various tRNAs** and the frequency of various codons influence the rate of polypeptide synthesis?
- What is the **minimal number** of different tRNA-amino acid synthetases in a cell?
- Would you expect a ribosome to make **mistakes** in amino acid incorporation or polypeptide termination? How are such mistake similar to and different from mutations?

Start codon (initiator tRNA (methionine)



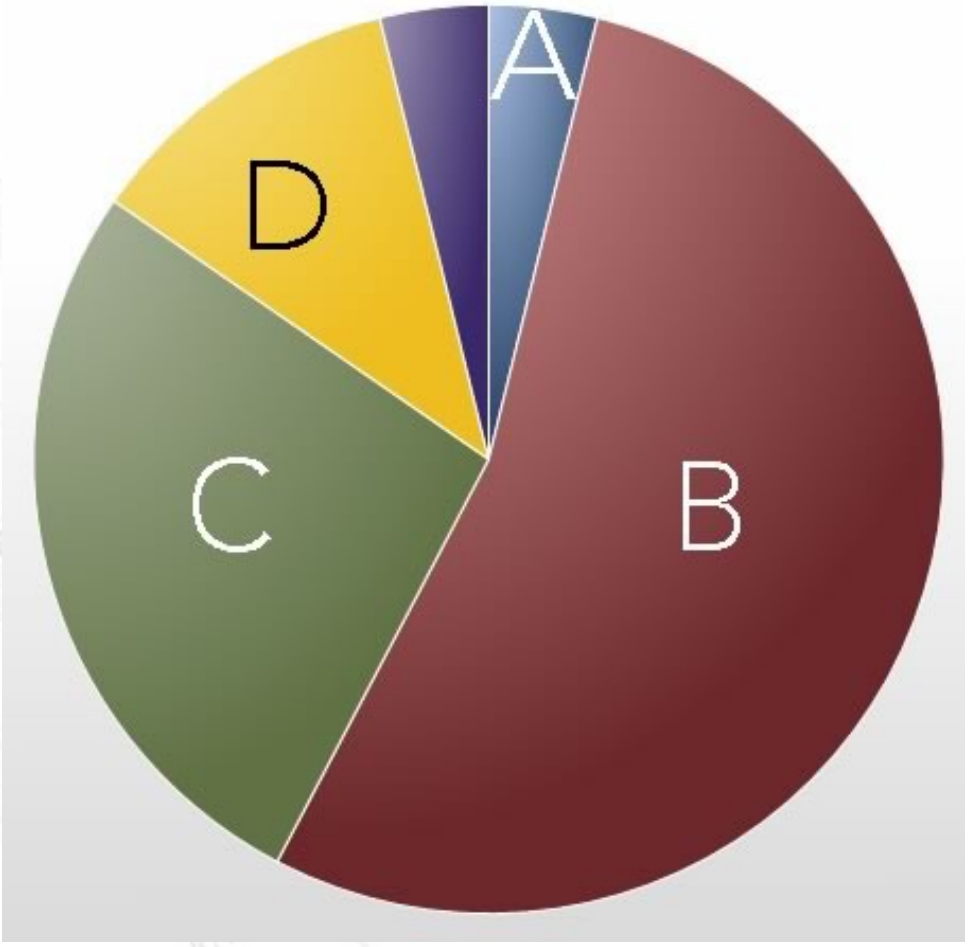


stop codon
release factor



How would a mutation in the gene that encodes release factor influence the cell?

- A. there would be no observable effect
- B. it would cause polypeptide synthesis to terminant prematurely
- C. it would led to C-terminal extension to many (most) proteins
- D. it would lead to aberrant translation start sites
- no idea

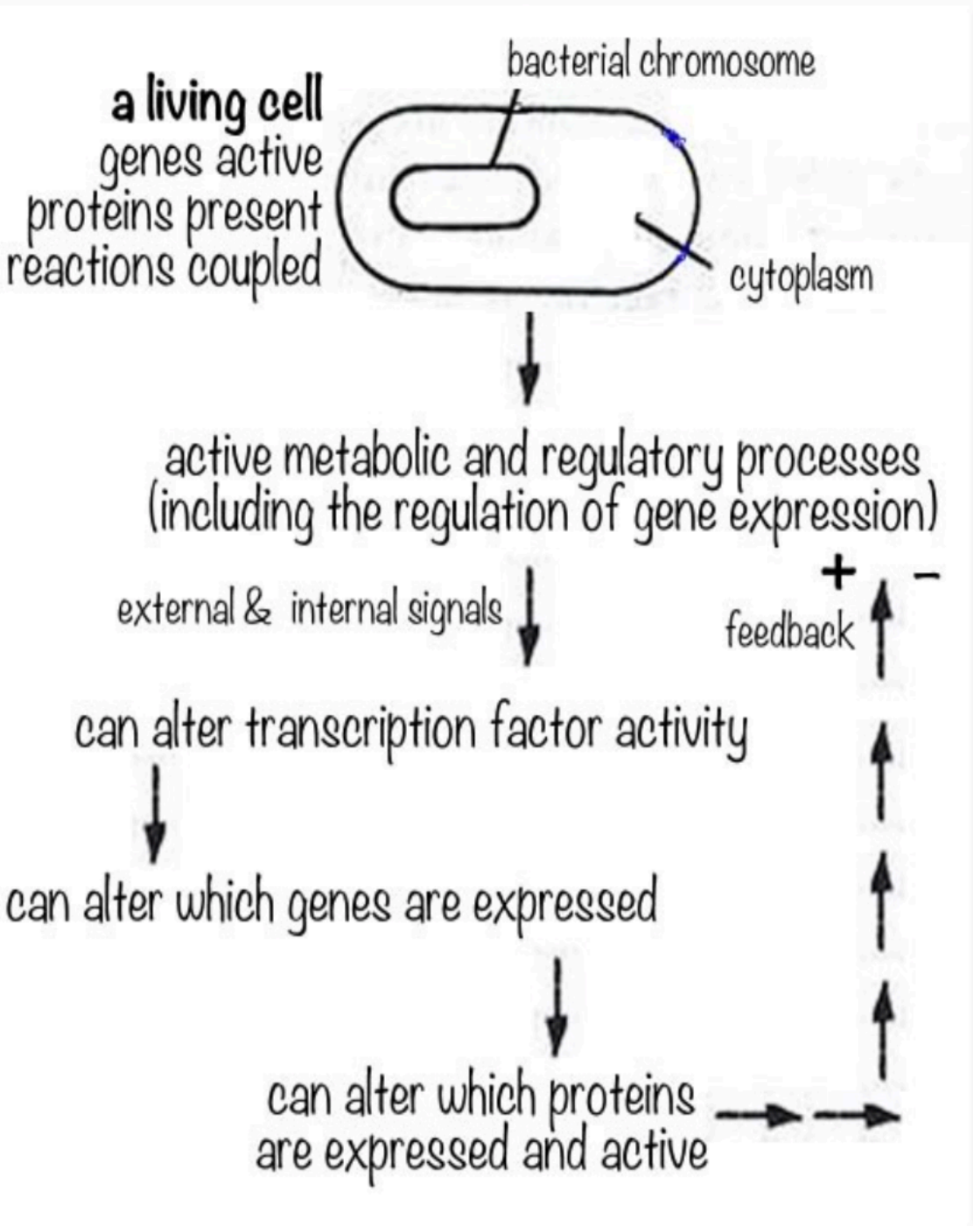


Questions to answer:

- How would you explain the **terms "up-stream" and "down-stream"** in terms of gene structure.
- What effects on polypeptide synthesis arise from neglecting **codon bias**?
- Why don't release factors cause the premature termination of translation at non-stop codons?

Questions to answer:

- What will happen if a ribosome starts translating an mRNA at the "wrong" place?
- When analyzing the effects of a particular non-sense or mis-sense mutation (allele), what factors would you consider first?
- How would you go about reengineering an organism to incorporate non-biological amino acid in its proteins


bacterial chromosome
a living cell
genes active
proteins present
reactions coupled
cytoplasm
active metabolic and regulatory processes
(including the regulation of gene expression)
external & internal signals
+
−
feedback
can alter transcription factor activity
can alter which genes are expressed
can alter which proteins
are expressed and active

tricky question to answer:

There are a number of cases when either transcription and translation occur in bursts, that is, a number of RNAs or polypeptides are synthesized in a short time, followed by a quiet period with no synthesis, and then another burst. What kind of plausible mechanism can you propose (given what you know about transcription and translation, and molecular level behaviors) for this bursting phenomena?