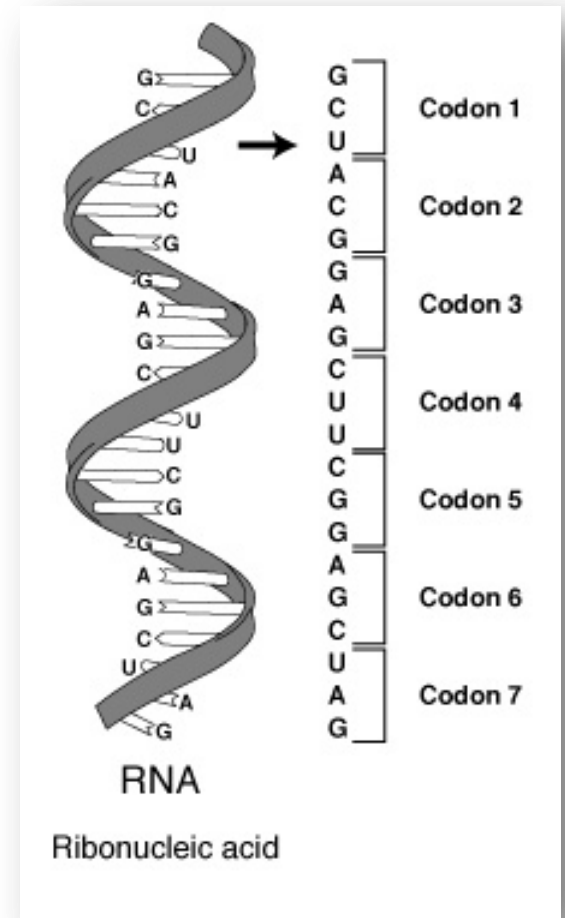
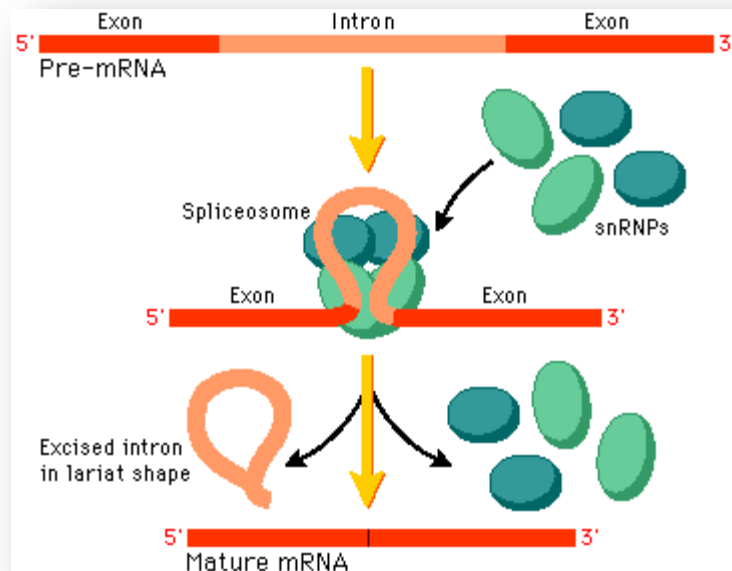


Central Dogma Revisited

- In going from DNA to proteins, there is an intermediate step where mRNA is made from DNA, which then makes protein
- Why the intermediate step?

DNA is kept in the nucleus, while protein synthesis happens in the cytoplasm, with the help of ribosomes



Revisiting the Code

Reading Frames

- Since nucleotide sequences are “read” three bases at a time, there are three possible “frames” in which a given nucleotide sequence can be “read” (in the forward direction)
- Taking the complement of the sequence and reading in the reverse direction gives three more reading frames



Illustration of possible reading frames:

AGG·TGA·CAC·CGC·AAG·CCT·TAT·ATT·AGC
A·GGT·GAC·ACC·GCA·AGC·CTT·ATA·TTA·GC
AG·GTG·ACA·CCG·CAA·GCC·TTA·TAT·TAG·C

Revisiting the Code

Open Reading Frames

- Concept: Region of DNA or RNA sequence that could be translated into a peptide sequence (open refers to **absence** of stop codons)
- Prerequisite: A specific genetic code
- Definition:
 - **(start codon) (amino acid coding codon) (stop codon)**
- Note: Not all ORFs are actually used

```
1.  ATG CAA TGG GGA AAT GTT ACC AGG TCC GAA CTT ATT GAG GTA AGA CAG ATT TAA
2.  A  TGC AAT GGG GAA ATG TTA CCA GGT CCG AAC TTA TTG AGG TAA GAC AGA TTT AA
3.  AT  GCA ATG GGG AAA TGT TAC CAG GTC CGA ACT TAT TGA GGT AAG ACA GAT TTA A
```

Sample sequence showing three different possible reading frames. Start codons are highlighted in purple, and stop codons are highlighted in red.

Exercise 1

- Open the file (yersinia_genome.fasta) with the complete Yersinia genome and find the possible start and end positions of its genes.

TIPS:

- The beginning of each gene is mapped by the following pattern. There is an 8 letter consensus known as the Shine-Dalgarno sequence (TAAGGAGG) followed by 4-10 bases downstream before the initiation codon (ATG). However there are variants of the Shine-Dalgarno sequence with the most common of which being [TA][AC]AGGA[GA][GA].
- The end of the gene is specified by the stop codon TAA, TAG and TGA. It must be taken care that the stop codon is found after the correct Open Reading Frame (ORF).
- Don't forget to check the reverse complement!