

BIOLOGICAL FRAMEWORKS FOR ENGINEERS

Session #3 [nm: Information Handling and the Genetic Code]

General Objectives:

- ✓ Review central dogma of molecular biology and DNA basics
- ✓ Discuss replication, transcription, and translation and clarify information handling in cells
- ✓ Discuss the possibilities of genetic coding and rationale

Central Framework:

- ✓ Genetic information stored in DNA, codes for the synthesis of trillions of proteins using a safe, redundant mechanism.

Interactive Activity:

- ✓ Discussion on information handling parallels between a computer and a cell; worksheet examining the genetic code and sequencing.

Session Outline:

I. Replication, Transcription, and Translation in Detail

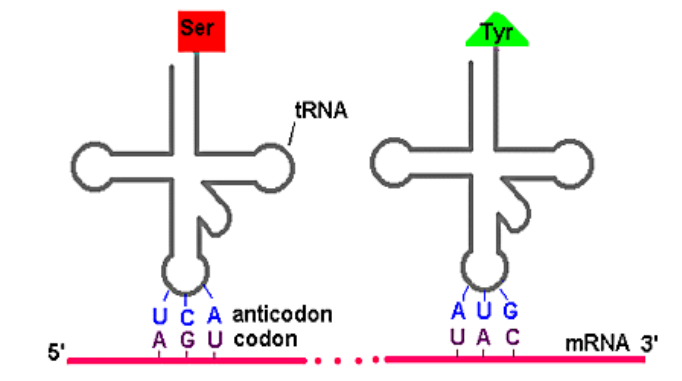
A. Central dogma of molecular biology

B. Replication

C. Transcription

D. Translation

II. The Genetic Code



| | | 2nd base in codon | | | | | |
|-------------------|---|--------------------------|--------------------------|----------------------------|---------------------------|------------------|-------------------|
| | | U | C | A | G | | |
| 1st base in codon | U | Phe Phe Leu Leu | Ser Ser Ser Ser | Tyr Tyr STOP STOP | Cys Cys STOP Trp | U C A G | 3rd base in codon |
| | C | Leu Leu Leu Leu | Pro Pro Pro Pro | His His Gln Gln | Arg Arg Arg Arg | U C A G | |
| | A | Ile Ile Ile Met | Thr Thr Thr Thr | Asn Asn Lys Lys | Ser Ser Arg Arg | U C A G | |
| | G | Val Val Val Val | Ala Ala Ala Ala | Asp Asp Glu Glu | Gly Gly Gly Gly | U C A G | |

The Genetic Code

IN-CLASS DISCUSSION: Parallels between information handling on a computer and in cells

1. How is the stored information handled and what are the basic units?

Computer

Cell

2. How is information copied and what are the steps?

Computer

Cell

3. How is information retrieved and what are the steps?

Computer

Cell

4. Using the genetic code table (above), fill in the following. For the amino acid sequence, start with the first ATG of the sense strand. (The sense strand is the one that is in the same orientation as the mRNA strand; the antisense strand is the one that gets copied into mRNA.) It helps to mark off the codons by threes.

DNA (5') G G A T A G C A T G A A A C C C G C A T A A (3') (sense strand)

(3')

(5') (antisense strand)

mRNA (5')

amino acid

5. A coding region in an mRNA of 1.6 kb would produce a polypeptide of _____ (how many?) amino acids. (kb = kilobases, 1000 bases or nucleotides)