1 Exercise solutions – Introduction

1. **Eukaryotic and prokaryotic cells**

   Cells are the most basic building blocks of all living organisms. Several aspects differ between prokaryotic and eukaryotic cells.

   (a) Which one of the two cell types, prokaryotes or eukaryotes, lacks a distinct nucleus?

   Solution: Prokaryotes

   (b) Can eukaryotes be unicellular?

   Solution: Yes

2. **Cell organelles**

A cell consists of a number of specialized subunits called organelles. Answer the most suitable organell that matchs the explanation.

(a) The key role of this organelle is to produce energy rich molecules for the cell.

Solution: Mitochondria

(b) It is a membrane-enclosed organelle. It contains genetic material called chromosomes.

Solution: Nucleus

3. **DNA**

Deoxyribonucleic acid (DNA) is an important molecule that stores generic information. DNA consists of four different nucleotides - Adenine (A), Cytosine (C), Guanine (G), and Thymine (T).

(a) What is the DNA sequence when its opposite strand is ACCGT?

Solution: TGGCA

4. **Central dogma of molecular biology**

   The central dogma of molecular biology describes the flow of genetic information by three processes - Replication, Transcription, and Translation.

   (a) What are the two main molecules involved in transcription?

   Solution: DNA and RNA

   (b) What are the two main molecules involved in translation?

   Solution: RNA and protein

5. **RNA**

Ribonucleic acid (RNA) conveys genetic information from its corresponding DNA to ribosome where proteins are synthesized. Similar to DNA, RNA has four different forms - Adenine (A), Cytosine (C), Guanine (G), and Uracil (U).

(a) What is the transcribed RNA sequence when the corresponding DNA sequence is TATAGC?

Solution: UAUAGC

6. **Genetic code**

The genetic code defines how three RNA nucleotides, called codon, should be translated into an amino-acid.

First position	*Second position*				*Third position*
	T	C	A	G	
T	F	S	Y	C	T
	F	S	Y	C	C
	L	S	*Stop*	*Stop*	A
	L	S	*Stop*	W	G
C	L	P	H	R	T
	L	P	H	R	C
	L	P	Q	R	A
	L	P	Q	R	G
A	I	T	N	S	T
	I	T	N	S	C
	I	T	K	R	A
	M	T	K	R	G
G	V	A	D	G	T
	V	A	D	G	C
	V	A	E	G	A
	V	A	E	G	G

A	Ala	Alanine
C	Cys	Cysteine
D	Asp	Aspartic acid
E	Glu	Glutamic acid
F	Phe	Phenylalanine
G	Gly	Glycine
H	His	Histidine
I	Ile	Isoleucine
K	Lys	Lysine
L	Leu	Leucine
M	Met	Methionine
N	Asn	Asparagine
P	Pro	Proline
Q	Gln	Glutamine
R	Arg	Arginine
S	Ser	Serine
T	Thr	Threonine
V	Val	Valine
W	Trp	Tryptophan
Y	Tyr	Tyrosine

(a) Stop codons are special codons that terminate the protein synthesis. Specify all three stop codons.

Solution: UAA, UGA, UAG

(b) Both one-letter and three-letter abbreviations are often used instead of the full names. What is the three-letter abbreviation of Tyrosine?

Solution: Tyr

(c) What is the one-letter abbreviation of the amino acid that is synthesized from the codon AGA?

Solution: R (Arginine)