

# 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 organelle that matches 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.

<i>First position</i>	<i>Second position</i>				<i>Third position</i>
	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)