

# Exercise sheet 1: Biology Basics

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## Exercise 1 - General

Here are some general biology questions. Using the Possible Solutions tab will convert each question to multiple choice

**Question 1A** Where is the genome stored in prokaryotes and eukaryotes?

**Hint : Possible Answers**

- ☐ Inside the nucleus in eukaryotes
- ☐ Outside the cell in prokaryotes
- ☐ Prokaryotes have no genome
- ☐ Inside the nucleolus in prokaryotes
- ☐ In chromatin in eukaryotes
- ☐ Partially in mitochondria in prokaryotes
- ☐ Directly inside the cell in prokaryotes

**Correct Answer**

- ☒ Inside the nucleus in eukaryotes
- ☒ Directly inside the cell in prokaryotes

**Question 1B** Name two more differences between prokaryotes and eukaryotes?

**Hint : Possible Answers**

- ☐ Prokaryotes have compartmentation through membrane
- ☐ Eukaryotes are not multi-cellular organisms
- ☐ Prokaryotes have mitochondria

- ☐ Eukaryotes have no nucleus
- ☐ Prokaryotes have no ER
- ☐ Eukaryotes are single cell organisms
- ☐ Eukaryotes have no flagellum

**Correct Answer**

- ☒ Prokaryotes have no ER

**Question 1C** List examples of prokaryotes and eukaryotes.

**Hint : Possible Answers**

- ☐ Escherichia coli is a prokaryote
- ☐ Amoebas are prokaryotes
- ☐ Fungi are eukaryotes
- ☐ Archaea are eukaryotes
- ☐ Insects are eukaryotes
- ☐ Salmonella is a prokaryote
- ☐ Plasmodium malariae is a prokaryote

**Correct Answer**

- ☒ Escherichia coli is a prokaryote
- ☒ Fungi are eukaryotes
- ☒ Insects are eukaryotes
- ☒ Salmonella is a prokaryote

**Question 1D** What are the three information-carrying biopolymers?

**Hint : Possible Answers**

- ☐ Protein
- ☐ Cellulose
- ☐ DNA
- ☐ Polysaccharides
- ☐ RNA
- ☐ amino acid
- ☐ nucleotide

**Correct Answer**

- ☒ Protein
- ☒ DNA
- ☒ RNA

**Question 1E** What is denoted by the “Central Dogma” of molecular biology?

**Hint : Possible Answers**

- ☐ Protein can make Protein
- ☐ DNA can make DNA
- ☐ Protein can make RNA and then RNA makes DNA
- ☐ DNA can make RNA and then RNA makes Protein
- ☐ RNA can make RNA
- ☐ DNA can make RNA and then RNA makes DNA
- ☐ Protein can make DNA

**Correct Answer**

- ☒ DNA can make DNA
- ☒ DNA can make RNA and then RNA makes Protein
- ☒ RNA can make RNA
- ☒ DNA can make RNA and then RNA makes DNA

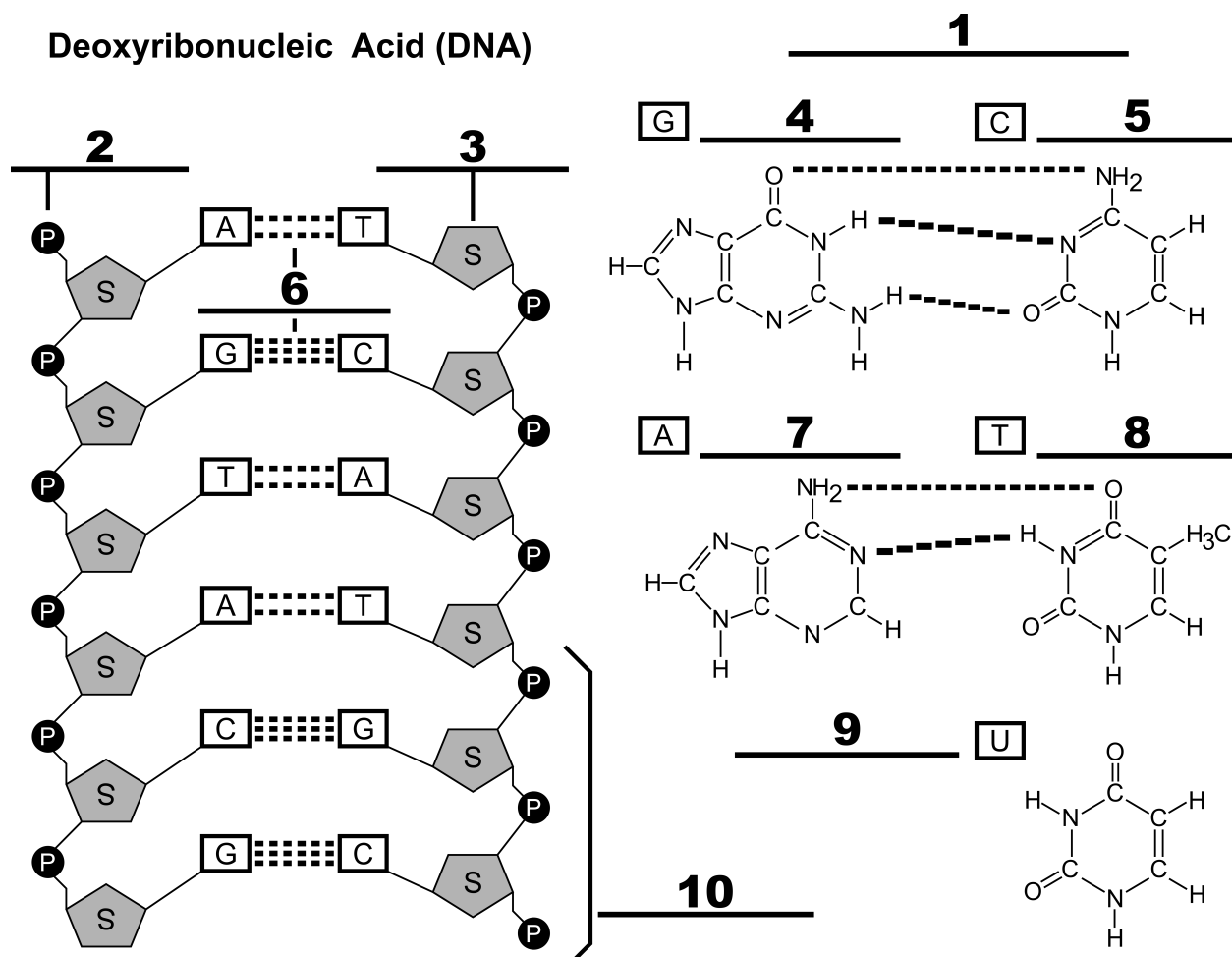
## Exercise 2 - DNA and RNA

The genetic information of an organism is stored in the DNA in the form of a code. This code consists of four building blocks or bases (A for adenine, C for cytosine, G for guanine, T for thymine). These bases or nucleotides follow each other in a certain sequence, e.g.:

AGTCGTAATTGGCCCCAATTGCAAAAA

A single hereditary unit consists of a subsequence of DNA (called a gene), which contains the information to build a functional RNA or protein molecule.

**Question 2A** Match these terms to the correct number in the figure below: adenine, thymine, cytosine, guanine, uracil, phosphate, deoxyribose, hydrogen bond, backbone, and bases.



**Hint**

1. bases

2.

3. deoxyribose
- 4.
- 5.
6. hydrogen\_bond
- 7.
8. thymine
- 9.
10. backbone

**Correct Answer**

1. bases
2. phosphate
3. deoxyribose
4. guanine
5. cytosine
6. hydrogen\_bond
7. adenine
8. thymine
9. uracil
10. backbone

**Question 2B** A piece of DNA contains 33% guanine. What are the percentages of adenine, cytosine, and thymine in that piece of DNA?

**Hint** What is the percentage of cytosine?

What is the combined percentage of guanine and cytosine?

What is the combined percentage of adenine and thymine?

**Correct Answer**

- guanine: 33%
- cytosine: 33%
- adenine: 17%
- thymine: 17%

**Question 2C** Decide which bases are pyrimidines and which are purines: A for adenine, C for cytosine, G for guanine, T for thymine, U for uracil.

**Hint**

**Correct Answer**

**Question 2D** Which of these statements concerning DNA and RNA are correct?

- ☐ Uracil is a standard base in RNA
- ☐ DNA is longer than RNA
- ☐ DNA and RNA have a different structure
- ☐ RNA has an intermolecular double-helix structure
- ☐ RNA contains ribose sugar

**Hint**

**Correct Answer**

**Question 2E** In what direction is an RNA sequence written?

**Hint**

- ☐ 3' end to 5' end
- ☐ 5' end to 3' end

**Correct Answer**

**Question 2F** Why is the RNA sequence written in that direction?

**Hint: Possible Answers**

- ☐ The order is based on the numbering of the carbons in the sugar of the nucleic acid
- ☐ The order is based on the numbering of the carbons in the phosphate of the nucleic acid
- ☐ The order was arbitrarily chosen by the discoverer of RNA

**Correct Answer**

**Question 2G** Decide for the following RNAs whether they are coding or non-coding: mRNA, tRNA, rRNA, microRNA, siRNA, snoRNA

**Hint** There is only one coding RNA

**Correct Answer**

- coding: mRNA
- non-coding: tRNA, rRNA, microRNA, siRNA, snoRNA

## Exercise 3 - DNA and RNA

**Question 3A** What do these acronyms stand for within this course?

- DNA
- RNA
- ncRNA
- mRNA
- UTR
- ORF
- CDS

**Hint**

- ☐ non-coding-RNA
- ☐ Opposite-Reading-Frame
- ☐ Deoxyribonucleic acid
- ☐ non-complementary-RNA
- ☐ missense-RNA
- ☐ messenger-RNA
- ☐ ribonucleic acid
- ☐ untranslated region
- ☐ coding-strand
- ☐ coding-sequence
- ☐ open reading frame

**Correct Answer**

- ☒ DNA - Deoxyribonucleic acid
- ☒ RNA - Deoxyribonucleic acid
- ☒ ncRNA - non-coding-RNA
- ☒ mRNA - messenger-RNA
- ☒ UTR - untranslated region
- ☒ ORF - open reading frame
- ☒ CDS - coding-sequence

**Question 3B** Check whether the following terms belong to Eukaryotes, Prokaryotes or both.

DNA

- ☐ Eukaryotes
- ☐ Prokaryotes

splicing

- ☐ Eukaryotes
- ☐ Prokaryotes

transcription

- ☐ Eukaryotes
- ☐ Prokaryotes

ncRNA”

- ☐ Eukaryotes
- ☐ Prokaryotes

single-cell-organism

- ☐ Eukaryotes
- ☐ Prokaryotes

**Hint** DNA - [ ] Eukaryotes - [ ] Prokaryotes

splicing

- V Eukaryotes
- x Prokaryotes

transcription

- V Eukaryotes
- V Prokaryotes

ncRNA”

- ☐ Eukaryotes
- ☐ Prokaryotes

single-cell-organism

- ☐ Eukaryotes



☐ Prokaryotes

**Correct Answer** DNA

- ☒ Eukaryotes
- ☒ Prokaryotes

splicing

- ☒ Eukaryotes
- ☐ Prokaryotes

transcription

- ☒ Eukaryotes
- ☒ Prokaryotes

ncRNA”

- ☒ Eukaryotes
- ☒ Prokaryotes

single-cell-organism

- ☐ Eukaryotes
- ☒ Prokaryotes

**Question 3C** Check whether the following statements are True or False.

- ☐ The genome is stored in the nucleus
- ☐ FASTA files are used to store sequence information
- ☐ A Watson-Crick base pair describes a pyrimidine pairing with a purine
- ☐ A Watson-Crick base pair describes a purine pairing with a purine
- ☐ RNA is a single stranded bio-polymer

**Hint**

- ☐ The genome is stored in the nucleus
  - V FASTA files are used to store sequence information
- ☐ A Watson-Crick base pair describes a pyrimidine pairing with a purine
  - x A Watson-Crick base pair describes a purine pairing with a purine
- ☐ RNA is a single stranded bio-polymer

**Correct Answer**

- ☐ The genome is stored in the nucleus
- ☒ FASTA files are used to store sequence information
- ☒ A Watson-Crick base pair describes a pyrimidine pairing with a purine
- ☐ A Watson-Crick base pair describes a purine pairing with a purine
- ☐ RNA is a single stranded bio-polymer