Bioinformatics 1  
WS 2018/2019

Exercise Sheet 1 Biology basics - DNA/RNA

Exercise 1 - general

a) Where is the genome stored in prokaryotes and eukaryotes?
b) Name two more differences between prokaryotes and eukaryotes?
c) Name examples for an organism for prokaryotes and eukaryotes.
d) What are the three information-carrying biopolymers?
e) What is denoted by the “Central Dogma” of molecular biology?

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.

\[ ...AGTCGTAATGGCCCAATTGCAAAAA... \]

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

a) Fill in the following names in the figure below: adenine, thymine, cytosine, guanine, uracil, phosphate, deoxyribose, hydrogen bond, backbone, and bases.
b) A piece of DNA contains 33% guanine. What are the percentages of adenine, cytosine, and thymine in that piece of DNA?

c) What are purines and pyrimidines?

d) What are the differences between DNA and RNA?

e) In what direction is an RNA sequence written?

f) Why is the direction defined by the notation 5' to 3'?

g) What is an RNA called that contains “coding” information and what is an RNA called that does not contain such information?
Exercise 3 - Coming to terms with biological terms

a) The following are very common acronyms that you should. What do they stand for?

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

b) Put the following terms into a mind map (graph with nodes for terms and edges for having a logical relationship, e.g. an organism consist of cell(s) so you could draw a line between the terms organism and cell). Try to avoid lots cyclic paths, i.e. only denote “close” relationships and not something like every animal has molecules that form basepairs—so no line between animal and basepairs. There will be several solutions, this is an exercise to help you get an overview of the given material.

Biological terms: genetic material, DNA, RNA, genome, nucleus, eukaryote, prokaryote, cell, transcription, translation, mRNA, ncRNA, protein, basepairs, gene expression, gene product, splicing.