Glossary

DNA (deoxyribonucleic acid) is a polymer—a very long molecule consisting of repetitive subunits. It carries the genetic instructions used in the growth, development, functioning, and reproduction of all known living organisms. Its building blocks, called nucleotides, consist of three main parts: deoxyribose (sugar), a nitrogenous base, and a phosphate group. There are four different bases: adenine (A), cytosine (C), thymine (T), and guanine (G). The order of these bases is *the genetic information* - the prescription for the protein synthesis. One strand of DNA would be enough to contain all the genetic information. However, DNA is usually double-stranded: two complementary bases are always joined together (T with A and G with C). Some viruses, however, have single-stranded DNA genomes.

RNA is very similar to DNA. Unlike DNA, however, it is usually single-stranded (but there are double-stranded RNA viruses), contains ribose instead of deoxyribose (hence the difference in the name), and instead of the base thymine, it contains the base uracil. RNA is crucial in the process of protein formation: it acts as an intermediary between the DNA and the protein sequence, and therefore it is important in the decoding and the regulation of genes. Similarly to DNA, RNA can also be copied and thus serve as a keeper of genetic information. Some viruses actually rely on RNA to store their genetic information. All known living organisms (viruses are traditionally not considered to be living organisms) are, however, relying on more stable DNA.

Proteins, similar to DNA and RNA, are also long chains of smaller subunits - amino acids. The sequence of amino acids determines how the chain folds and twists itself into a complex, three-dimensional molecule - a mature protein. The sequence of amino acids is encoded in the DNA. Therefore, every small change in the DNA –a mutation– can result in the change of the amino acid sequence, which, in turn, may result in an improperly folded and defective protein. Proteins are crucial for living organisms - they perform most functions in living organisms: they mediate biochemical reactions, such as metabolism and respiration, act as messengers, provide structure, and transport nutrients.

Transcription is the process of rewriting a DNA sequence into a complementary RNA sequence. Instead of thymine, uracil is recruited to complement adenine bases. Transcription is the first step in the process of gene expression - the formation of proteins according to the instructions contained in the DNA. During transcription, the two strands that make up the DNA molecule separate from one another. Using one of these strands as a template, the RNA molecule is then made from free nucleotides available in the cell. The new RNA molecule is complementary to the template DNA strand in the same way the original two strands of the DNA are: cytosine always pairs with guanine and thymine always pairs with adenine. There is one important exception: instead of thymine, RNA always uses uracil. The RNA is then translated into the sequence of amino acids in the process of translation.

Reverse transcription is the process very similar to transcription described above, but in reverse: the RNA molecule is transcribed into a DNA molecule.