

Difference Between Oligonucleotide and Polynucleotide

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Key Difference – Oligonucleotide vs Polynucleotide

[Nucleotides](#) are the basic structural units that synthesize complex polymeric forms of both [DNA](#) (deoxyribose nucleic acid) and [RNA](#) (ribose nucleic acid). Nucleotides are organic molecules. They are composed of three basic subunits: a nitrogenous base, [pentose](#) sugar ([ribose/deoxyribose](#)) and a [phosphate](#) group. The DNA and RNA synthesized from nucleotides act as essential biomolecules in a living system. There are many types of nucleotides, including oligonucleotides and polynucleotides. **Oligonucleotides are short segments DNA and RNA with one or more nucleotide monomers whilst polynucleotides are biopolymers with 13 or more nucleotide monomers.** This is the key difference between oligonucleotides and polynucleotides.

What is an Oligonucleotide?

Short segments of DNA and RNA molecules are known as oligonucleotides. They are widely used in the fields of forensic science, genetics, and research. Oligonucleotides can be produced by a process known as solid phase chemical synthesis done inside a laboratory. They are produced as single stranded molecules with a sequence that is specified to a particular function and is an important aspect in the context of [PCR](#) (Polymerase Chain Reaction), [DNA microarrays](#), [southern blot technique](#), FISH (fluorescent in situ hybridization), synthesis of artificial genes, production of DNA/RNA libraries and act as molecular probes.

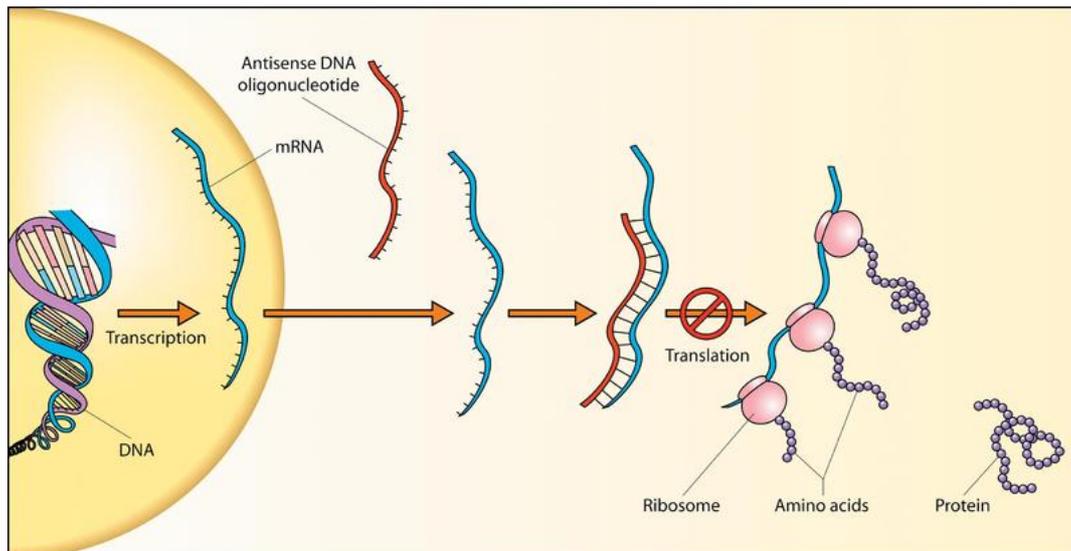


Figure 01: Oligonucleotide

Oligonucleotides naturally occur as microRNA, small molecules of RNA which regulate [gene expression](#). Oligonucleotides can also be present due to the catabolism of larger nucleic acids. The entire molecule is characterized and developed by a sequence of nucleotide residues. Oligonucleotides composed of fragments of DNA is utilized during PCR, a process by which a minute amount of DNA could be amplified into millions of copies. Here, oligonucleotides act as primers that assist in the functioning of [DNA polymerase](#). A chemically or naturally modified nucleoside known as phosphoramidite acts as the main component during the synthesis of oligonucleotides. The synthesis of the oligonucleotide strand occurs from 3' end to 5' end in a cyclic pathway referred to as a synthetic cycle. On the completion of one synthetic cycle, a single nucleotide is added to the growing chain.

What is a Polynucleotide?

A polynucleotide molecule consists of 13 or more nucleotide monomers and is referred to as a biopolymer. The monomers are bonded to the nucleotide chain covalently. DNA and RNA are examples of polynucleotides. The simplest polynucleotide in the living system is RNA (Ribonucleic Acid) which contains the pentose sugar ribose. RNA is composed of a single stranded polynucleotide. The molecule is made up of four nitrogenous bases, adenine, guanine, thymine and uracil. RNA is of many different types: [mRNA](#) (messenger RNA), [rRNA](#) (ribosomal RNA), [tRNA](#) (transfer RNA).

Deoxyribose nucleic acid (DNA) is another polynucleotide which consists of the pentose sugar deoxyribose. The nitrogenous bases are [adenine](#), [guanine](#), [thymine](#), and [cytosine](#) and are composed of two helically arranged polynucleotide chains. Adenine pair with thymine and guanine pair with

cytosine. This is referred to as complementary base pairing. Polynucleotides, both DNA and RNA, occur naturally in living organisms and are used in experiments of both biological and biochemical. Polynucleotides are utilized in PCR and DNA sequencing. They can be synthesized artificially using oligonucleotides. To synthesize and extend the polynucleotide strand, new nucleotides are added, and the chain is extended by the presence of polymerase enzymes.

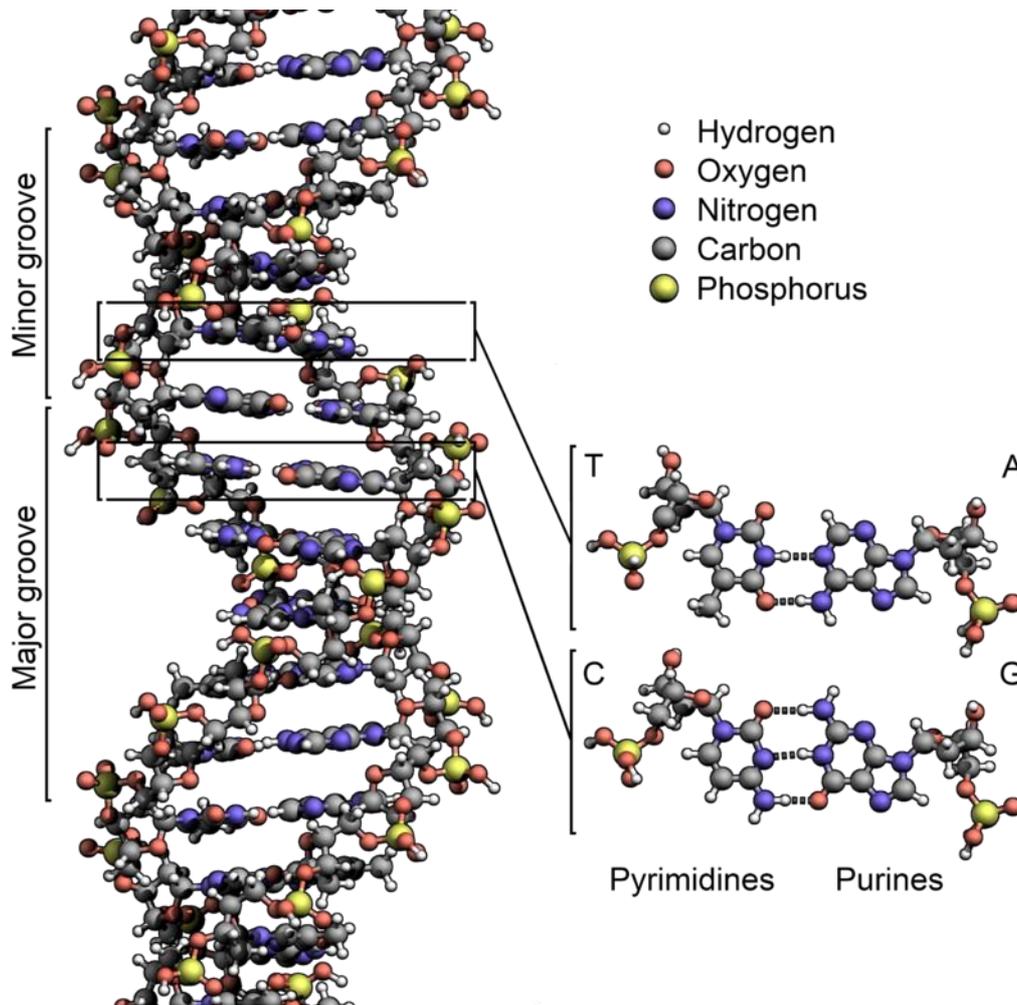


Figure 02: Polynucleotide

What are the similarities between Oligonucleotides and Polynucleotides?

- Oligonucleotides and polynucleotides are monomers of DNA and RNA
- Both are involved in many genetic techniques including FISH and PCR.

What is the difference between Oligonucleotides and Polynucleotides?

| Lignin vs Cellulose | |
|--|---|
| Oligonucleotide is a DNA or RNA fragment which is composed of one or more nucleotide monomers. | Polynucleotide is a biopolymer which is composed of 13 or more nucleotide monomers. |
| Size | |
| Oligonucleotide is shorter than polynucleotide. | Polynucleotide is longer than oligonucleotide. |
| Function | |
| Oligonucleotides are utilized in genetic techniques such as FISH, PCR, DNA micro array. | Polynucleotides are used in FISH, PCR, DNA sequencing, etc. |

Summary – Oligonucleotides vs Polynucleotides

Nucleotides are important biomolecules that involve in major metabolic functions in the living systems. They are the monomers of both DNA and RNA. Nucleotides are organic molecules and are composed of three basic subunits: a nitrogenous base, a pentose sugar, and a phosphate group. Oligonucleotides and polynucleotides are two important types of nucleotides. Both molecules are utilized in different genetic techniques, including FISH and PCR. Oligonucleotides are composed of one or more nucleotide monomers while polynucleotides are composed of 13 or more nucleotide monomers. Oligonucleotides are shorter than polynucleotides. This is the difference between oligonucleotides and polynucleotides.

References:

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2. Mandal, MD Dr Ananya. "What is an Oligonucleotide?" News-Medical.net, 10 Sept. 2014, [Available here](#). Accessed 31 Aug. 2017

Image Courtesy:

1. "Antisense DNA oligonucleotide" By Robinson R – RNAi Therapeutics: How Likely, How Soon? Robinson R PLoS Biology Vol. 2, No. 1, [Available Here](#) (CC BY 2.5) via [Commons Wikimedia](#)

2. “DNA Structure+Key+Labelled.pn NoBB” By Zephyris – Own work ([CC BY-SA 3.0](#)) via [Commons Wikimedia](#)

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