Nucleic acid hydrolysis

The nucleic acid chain can be cleaved either enzymatically or non-enzymatically.

A 2'-OH group is required for the **alkaline hydrolysis** of a polynucleotide, as its first step is the transfer of the bond from C5' of the following nucleotide to C2' of the same nucleotide. This breaks the axis of the polynucleotide and temporarily forms a cyclic 2',3'-phosphate, which is further degraded into a mixture of 2' and 3'-phosphates. It follows that heating in an alkaline environment hydrolyzes only RNA, while DNA is **alkali resistant**.

By mild **acid hydrolysis** (pH about 3), the β-glycosidic bond of purine nucleotide is selectively cleaved. The result is an apurine polynucleotide. Apyrimidine nucleic acid can be prepared by the action of hydrazine.

In a strongly acidic environment and at a higher temperature (HCl with a concentration of 6mol.l^{-1}, 175 °C), both RNA and DNA are split into individual components. In addition, cytosine is deaminated to uracil, which must be taken into account when determining the base ratio in a polynucleotide.

To determine the primary sequence of nucleic acids, **enzymatic hydrolysis** catalyzed by **nucleases** is more necessary. 3'- and 5'-**exonucleases** are distinguished, depending on which end of the polynucleotide they gradually cleave mononucleotides from. **Endonucleases** cleave bonds at a certain point within the chain, so that the product tends to be oligonucleotides of unequal length.

Endonucleases are pentose specific, there are **ribonucleases (RNases)** and **deoxyribonucleases (DNases)**. Another criterion for the specificity of nucleases is the half of the phosphodiester bond that they cleave. Nucleases cleaving the bond closer to C3' release nucleoside 3'-phosphates. **Restriction endonucleases** cleave the DNA double helix at a site of central symmetry in the nucleotide sequence.

Snake venom phosphodiesterase is a 3'-exonuclease cleaving α-bonds in both RNA and DNA. Bovine spleen phosphodiesterase is a 5'-exonuclease cleaving polynucleotide b-bonds. Pancreatic RNase is an endonuclease that cleaves b-bonds in RNA if a pyrimidine nucleotide is attached to the a-bond of the given phosphate. RNase T cleaving the b-bonds of those phosphates where a purine nucleotide is attached to the a-bond was isolated from the fungus.

Links

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Resources

- PINCH, Stanislav. *Concise Biochemistry : Storage and expression of genetic information.* 1. edition. Medprint, 1998. 92 pp. pp. 12–13. ISBN 80-902036-2-0.