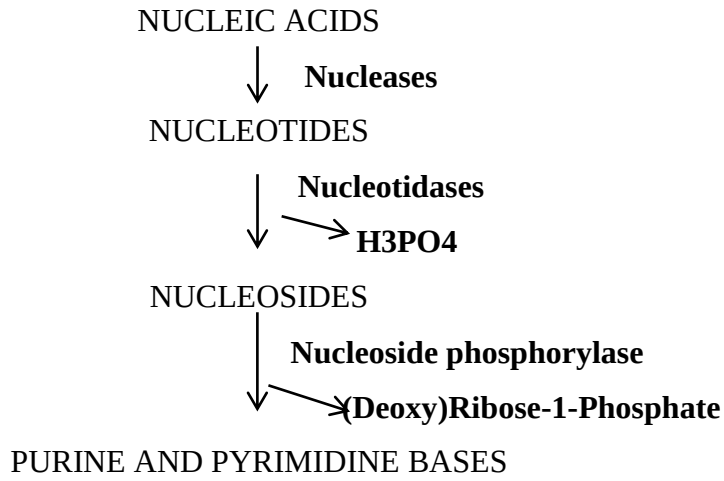
QUESTION: **Write short notes about Nucleic acid degradation.**

Introduction

Nucleic acids are the bearers of genetic material in all living organisms. They are very important not just in this area but in the metabolic activities of the cells of living organisms as well. As such nucleic acid degradation can also be referred to as nucleic acid catabolism (a form of metabolism) because it involves the breakdown of nucleic acids. The building blocks of nucleic acids are the nucleotides which are composed of a pentose sugar (ribose or 2-deoxy ribose), a nitrogenous base (adenine, guanine, cytosine, thymine, and uracil) and a phosphate group. We therefore expect that the degradation of nucleic acids results into its building components.

The nucleic acids are capable of being broken down into sugars, phosphoric acid and a mixture of bases (both purines and pyrimidine). The sugar (pentose) can be metabolized to provide the only source of metabolic energy available from purine nucleotide degradation while the purine (adenine and guanine) and pyrimidine (Uracil, thymine and cytosine) also further degrade to their different fates. Below is a diagram that tries to summarize the break-down of nucleic acids till the base level. It also shows the groups of enzymes that are important in this degradation process.



The building blocks of nucleic acids are mainly derivatives of two very important bases, the purine and the pyrimidine. Just as their make-up is uniquely different, they also have different products (results) after their degradation.

PURINES

Purines are double ringed bases. The common derivatives of purines are adenine and guanine. Their catabolism is very essential as it provides raw material for nucleic acid salvage. The degradation of the purines occurs mainly in the liver.

The whole process involving the catabolism of purines is a complex one. However, for the assignment's sake below is a summary of what happens to both the adenine and guanine during their degradation.

- **Adenine:** "The nucleoside, adenosine, is then deaminated and hydrolyzed to form hypoxanthine via adenosine deaminase and nucleosidase respectively. Hypoxanthine is then oxidized to form xanthine and then uric acid through the action of xanthine oxidase" **(Wikipedia, 2016).**

- **Guanine:** "Guanosine is cleaved to form guanine. Guanine is then deaminated via guanine deaminase to form xanthine which is then converted to uric acid. Oxygen is the final electron acceptor in the degradation of both purines. Uric acid is then excreted from the body in different forms depending on the animal" **(Wikipedia, 2016).**

What is noticeable for both pathways of purine degradation is that they end up forming uric acid which is then excreted from the organism (body). Any disorder in the catabolic pathways may lead to medical complications. An example of such complications is where there is accumulation of excess uric acid forming gout. Gout is caused by the precipitation of sodium urate Biosynthesis of nucleic acids and proteins. Sodium urate crystals precipitate because the serum levels of urate exceed its solubility limit.

PYRIMIDINE

Pyrimidines are six membered heterocyclic aromatic rings containing two nitrogen atoms. The common derivatives include; thymine, cytosine and uracil. The products of pyrimidine degradation are excreted in the urine or converted to CO_2, H_2O and NH_3 (which forms urea). They do not cause any problems for the body, in contrast to urate, which is produced from the purines and can precipitate, causing gout.

The summary of the whole process is given through paragraphs found during my research.

- **Uracil and Cytosine:** "Cytosine and uracil are converted into beta-alanine and later to malonyl-CoA which is needed for fatty acid synthesis, among other things" **(Wikipedia, 2016).**

- **Thymine:** "Thymine, on the other hand, is converted into β-aminoisobutyric acid which is then used to form methylmalonyl-CoA" **(Wikipedia, 2016).**

Other products involved in the degradation such acetyl CoA and Succinyl join the krebs cycle. As the result, the ultimate end products of pyrimidine degradation are CO_2, H_2O and NH_3 as already stated above. Medical conditions that are involved due to irregularities in pyrimidine catabolism include diseases such as dihydropyrimidine dehydrogenase deficiency. This disease affects the nervous system very negatively.

Nucleic acid degradation is important in living systems because it sustains the cycle of nucleic acid synthesis. The intermediates are also important for other metabolic reactions in living systems. The products such as the pentose sugar and phosphoric acid also play important roles in cells.

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