Difference Between RNASE A and RNASE H

www.differencebetween.com

Key Difference - RNASE A vs RNASE H

The ribonucleases are nucleases that specifically degrade RNA into smaller units. They can be divided into two categories; endoribonucleases and exoribonucleases. Endoribonuclease is an endonuclease that can either degrade single stranded or double stranded RNA. It cleaves the phosphodiester bonds within a RNA polynucleotide chain. The examples are RNase A, RNase III, RNase T1, RNase P and RNase H. Exoribonuclease is an exonuclease that degraded RNA by removing terminal nucleotides from either 5'end or 3'end of the RNA molecule. The examples are RNase R, RNase II, RNase D and RNase PH. The **key difference** between RNASE A and RNASE H is, **RNase A is a pancreatic ribonuclease that specifically degrades single-stranded RNA into smaller components while RNase H is a non-specific enzyme that cleaves the RNA in RNA-DNA hybrid into smaller units via the hydrolytic mechanism.**

What is RNASE A?

The RNase A is a pancreatic ribonuclease that specifically cleaves the unpaired cytosine and uracil residues at 3' end of single-stranded RNA. RNase H works at a higher salt concentration (0.3M or higher NaCl concentration). The hydrolytic reaction is two steps. It forms a 3' phosphorylated product via 2', 3' cyclic monophosphate intermediate. Though it is specific to single-stranded RNA at higher salt concentration, it can also degrade double-stranded RNA and RNA in RNA-DNA hybrid at lower NaCl concentration (lower than 0.3M NaCl).

Bruce Merrifield first synthesized this enzyme. RNase A is a very popular enzyme in molecular research. Bovine pancreatic RNase A is an example of RNase A. And it is one of the hardiest enzymes that are used in the laboratory. This enzyme does not need a cofactor for its activity. It is a highly thermostable enzyme. RNase A is the first enzyme and the third protein to which a correct amino acid sequence was detected. This enzyme is very small with 124 amino acids and molecular mass of 12600da. And it has four Histidine residues (His 12 and His 119 which involve in catalytic reaction).

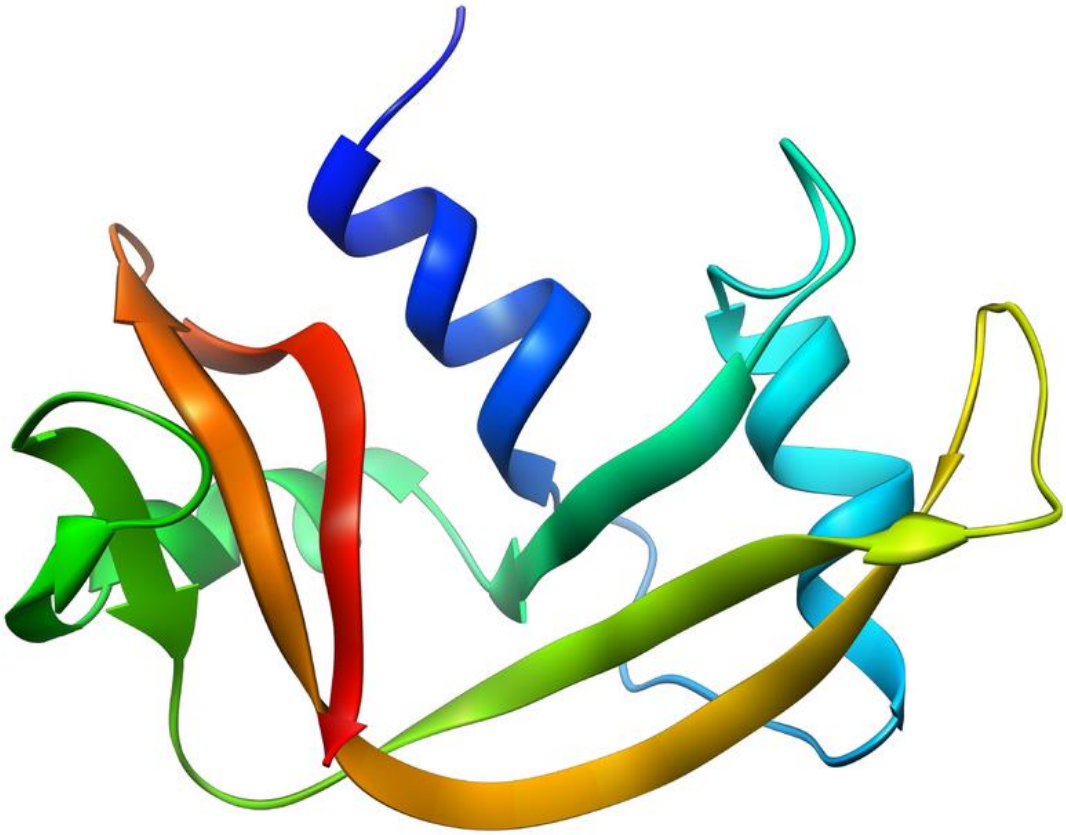

Figure 01: The RNase A

RNase A can be isolated by boiling a crude sample. When boils, all other enzymes degrade remaining RNase A. RNase A is an amazingly stable enzyme. This enzyme inhibits with ribonuclease inhibitor protein, heavy metal and uridine vanadate complexes.

What is RNase H?

The RNase H is a nonspecific ribonuclease enzyme that can degrade RNA in RNA-DNA hybrid via hydrolytic reaction. The RNase H cleaves the 3'- the O-P bond of RNA in an RNA-DNA hybrid. Ultimately it produces 3'OH and 5' phosphate terminated products. In DNA replication it plays a pivotal role by removing RNA primer after new DNA strands are formed. In laboratory conditions, it specifically degrades RNA in RNA-DNA hybrid but not DNA and unhybridized RNA. And this enzyme is usually used to destroy the RNA template after first complementary DNA strand is formed during cDNA synthesis.

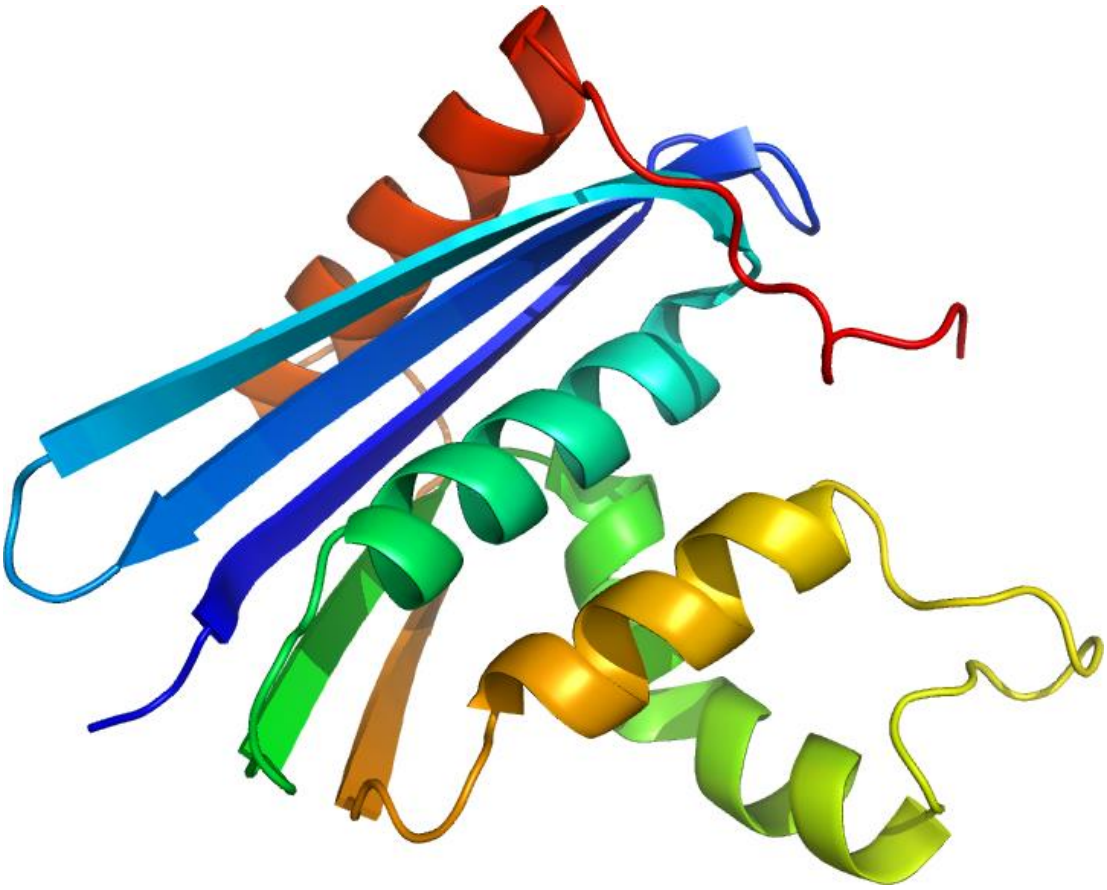

Figure 02: RNase H

RNase H also uses in nuclease protection assays. It can also be incorporated to the removal of poly A tail from mRNA. RNase H has the ability to destruct the non-coding RNA inside and outside of the cell. The metal ions are required as cofactors for this protein activity. A chelator (EDTA) can be used to inhibit the RNase H enzyme.

What are the Similarities Between RNASE A and RNASE H?

- Both are protein in nature.
- Both are endoribonuclease
- Both can degrade RNA.
- Both perform hydrolytic reactions.
- Molecular laboratories use both these.

What is the Difference Between RNASE A and RNASE H?

RNASE A vs RNASE H	
RNase A is a pancreatic ribonuclease that specifically cleaves the 3’ end of unpaired cytosine and uracil residues of single-stranded RNA at higher salt concentration.	RNase H is a nonspecific ribonuclease enzyme that can degrade RNA in RNA-DNA hybrid via hydrolytic reaction.
Nature of RNA Cleaving	
RNase A specifically cleaves single-stranded RNA at higher salt concentration.	RNase H cleaves RNA in RNA- DNA hybrid.
Need of Co-factors for Activity	
RNase A does not need cofactors for its activity.	RNase H needs metal ions as cofactors for its activity.
Inhibitors of Protein Activity	
Ribonuclease inhibitor protein, heavy metal and uridine vanadate complexes inhibits the RNAse A activity.	A chelator (EDTA) inhibits RNase H activity.
RNA Primer Removal in DNA Replication	
RNase A is not used for RNA primer removal in DNA replication.	RNase H is used for RNA primer removal in DNA replication
DNA Template Removal in Complementary DNA (C-DNA) Synthesis	
RNase A is not used for RNA template removal during complementary DNA (C-DNA) synthesis.	RNase H is used for RNA template removal during complementary DNA (C-DNA) synthesis.
Removal of Poly-A-Tail in mRNA Hybridized to Oligo (dt)	
RNase A is not used to remove “poly-A tail” in mRNA hybridized to oligo (dt).	RNase H is used to remove “poly-A tail” in mRNA hybridized to oligo (dt)

Summary - RNASE A vs RNASE H

The ribonucleases are nuclease enzymes that have the ability to cleave RNA into smaller units. They are two types; endoribonucleases and exoribonucleases. Endoribonuclease is an endonuclease which has the ability to degrade single-stranded or double-stranded RNA. And it cleaves the phosphodiester bond within an RNA polynucleotide chain. RNase A and RNase H are two endoribonucleases. RNase A is a pancreatic ribonuclease that specifically cleaves unpaired cytosine and uracil residues at 3' end of the single-stranded RNA at higher salt concentration. RNase H is a nonspecific ribonuclease enzyme that can degrade RNA in RNA-DNA hybrid via hydrolytic reaction. This is the difference between RNase A and RNase H.

Reference:

1.Karuturi, Author Amrutha. "17 need to know facts about RNase A." AG Blog, 22 Feb. 2017. Available here
2."Ribonuclease." Wikipedia, Wikimedia Foundation, 5 Jan. 2018. Available here

Image Courtesy:

1.'RNase A'By No machine-readable author provided. Vossman assumed (based on copyright claims)., (CC BY-SA 2.5) via Commons Wikimedia
2.'RNase H fix'By No machine-readable author provided. Vossman assumed (based on copyright claims)., (CC BY-SA 2.5) via Commons Wikimedia

How to Cite this Article?

APA: Difference Between RNASE A and RNASE H.(2018 January 10). Retrieved (date), from http://differencebetween.com/difference-between-rnase-a-and-vs-rnase-h/

MLA: "Difference Between RNASE A and RNASE H" Difference Between.Com. 10 January 2018. Web.

Chicago: "Difference Between RNASE A and RNASE H." Difference Between.Com. http://differencebetween.com/difference-between-rnase-a-and-vs-rnase-h/ accessed (accessed [date]).