International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2019): 7.583

# m-RNA Degradation in Prokaryotes and Eukaryotes: A Comparison Study of E.Coli and S. Cerevisiae

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**Abstract:** ***The messenger RNA degradation is a significant pathway for the control of gene expression in prokaryotes and eukaryotes. In the prokaryotes cells the synthesis of protein is controlled at any of three stages: Transcription, Translation and the Degradation of m-RNA. As the prokaryotes and eukaryotes cells are different in various aspects like in term of the presence or absence of nucleus but there is similarity for the control on gene for the messenger RNA degradation. The half life of m-RNA is variable from few seconds to hours for example: E.coli. These three enzymes are the ribonucleases. The bacteria are able to introduce changes in its m-RNA by changing the concentration of cell's ribonucleases. The multi-protein complex, which are associated with messenger RNA degradation, these complexes have different bio chemical path way and different features.***

**Keywords:** m-RNA degradation, E coli, Saccharomyces cerevisiae, NMD

## 1. Introduction

m-RNA degradation is a little bit complex process which is studied in E.coli and other eukaryotic species. It is a vital process that helps bacteria to change the method of protein synthesis. Its half life can be from few seconds to hours. almost all the mRNA molecules possess similar bond of phosphodiester with one exception of 5' methyl G cap in case of prokaryotes biochemically the method of degradation in both prokaryote and eukaryote is identical (for prokaryotes E.coli) & (for eukaryotes Saccharomyces cerevisiae).This article mainly focus on the comparison of m-RNA degradation in prokaryotes and eukaryotes. There are three enzymes, which play key role in event of messenger RNA degradation: RNase E, RNase J and RNase Y. The presence of these enzymes schedule the metabolism of m-RNA.

## 2. m-RNA degradation in case of prokaryotes (E.coli)

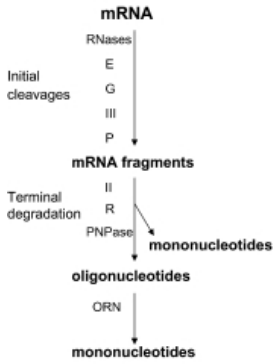
It purely depends on the organism to control its biological activity. This paper is concerned with the m-RNA degradation. As we are aware that all character in the organism are under the control of gene.

**Steps of m-RNA degradation:**

**(I) Initiation of m-RNA degradation:** The enzyme RNase is responsible for the catalyzation of 5s rRNA of 9s RNA in E coli. This entire process is performed in 2 steps at particular sites. The beginning of m- RNA decay occurs when RNase E works over it. Once it is broken down, it leads to formation of Oligonucleotides which generally carry 10-15 nucleotides. The degradation process can be studied on the basis of 2 concepts: one is chemical decay and other one is functional decay. The degradation products are measured by using gel electrophoresis in band form. [7]

The species of E.coli also have another type of endonuclease known as RNase G; this enzyme is more than 30% indistinguishable to RNase E. The decay in bacteria is a process coupled with degradosome, which are the multiprotein complex. These degradosome have RNase E, Enolase, Helicase and PNPase in it. In E.coli type of prokaryotes, as the process of polyadenylation starts it brings the use of PNPase and RNase type II. This polyadenylation represents the significant affect on the decay of partially or fully degraded m-RNA. [2]

**Degradation**

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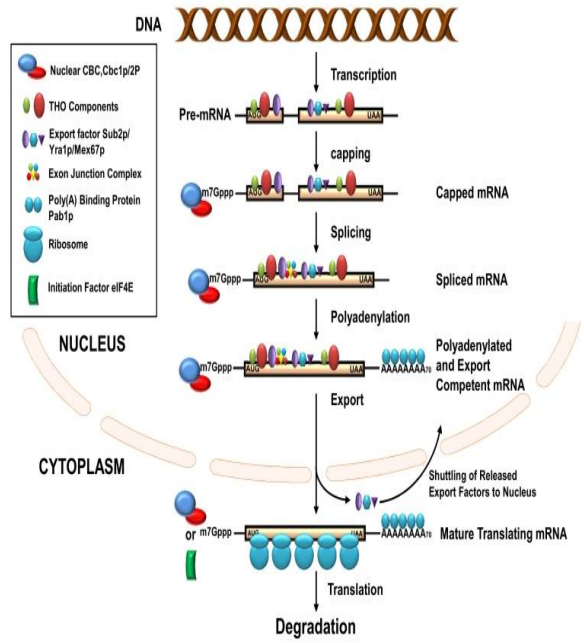
**(II) Termination of m-RNA degradation:** As E.coli cannot have the exonucleases which can proceed in 5' – 3' direction, its degradation always happens in 3' – 5' direction. In E.coli there are more than 7 exonucleases known to us which work in this process, 3 of them are synthesized in vitro (oligoribonuclease, PNPase and RNase II). It is well established fact that PNPase performs comparatively crucial job in m- RNA decay. Degradation of m-RNA is directly proportional to half life. The process of translation is also an influential factor for the m-RNA degradation [6]

The regulation of this decay in bacteria is purely associated with the gene expression; many species of bacteria have evolved this as a post-translational modification. This process is linked with the activity of ribonucleases. Many studies done in the present scenario shows that the decay process which begins with the RNase is actually under the control of sRNAs. RNA associated proteins; in case of Gram-ve species play their role for the family of sRNAs. [6]

## 3. m-RNA degradation in case of Eukaryotes (S. Cerevisiae)

**(I) Initiation of m-RNA degradation:** the degradation of mRNA in yeast takes place with several pathways but the most common one is deadenylation method. Deadenylation is the process of shortening of the Poly 3' [A] tail. [8] Once the process of deadenylation is done, next process is brought into the mechanism which removes the 5' methyl G cap. This process is only possible when the translational factor is already removed out from its location [eIF4E]. This process occurs in 5'-3' direction. Evidences also show that decapping is also possible in absence of deadenylation; this process is called Nonsense Mediated Degradation. This NMD also need some special proteins namely: Upf3p, Upf2p, and Upf1p. [2]




Source: http://microbialcell.com/researcharticles/the-interplay-between-transcription-and-mrna-degradation-in-saccharomyces-cerevisiae/figure-1-transcription-and-mrna-degradation-are-integrated/

**(II) Termination of m-RNA degradation:** cerevisiae doesn't have endonuclease for m-RNA degradation. There are certain similarities in prokaryotic and eukaryotic degradation such as PNPase and RNase. Although, it also needs some complex proteins known as Exosome which perform key role in this process. These proteins can function as Exonucleases & Endonuclease. [2]

## 4. Discussion

Both prokaryotic and Eukaryotic types of organisms have developed special pathways or mechanisms to degrade the synthesized messenger RNA. E. coli and S. cerevisiae, both types of organisms have special proteins as their cellular components, some of them are already made in the cell and some are synthesized during the degradation process.

## 5. Conclusion

It can be concluded that prokaryotes [E.coli] species have degradosome which contains RNase, PNPase, Enolase and RNA Helicase whereas Eukaryotes [S. cerevisiae] species has Exosome. There must be any similarity irrespective of the organisms because both [Degradosome & Exosome] are responsible for m-RNA degradation.

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