

# Difference Between Monocistronic and Polycistronic mRNA

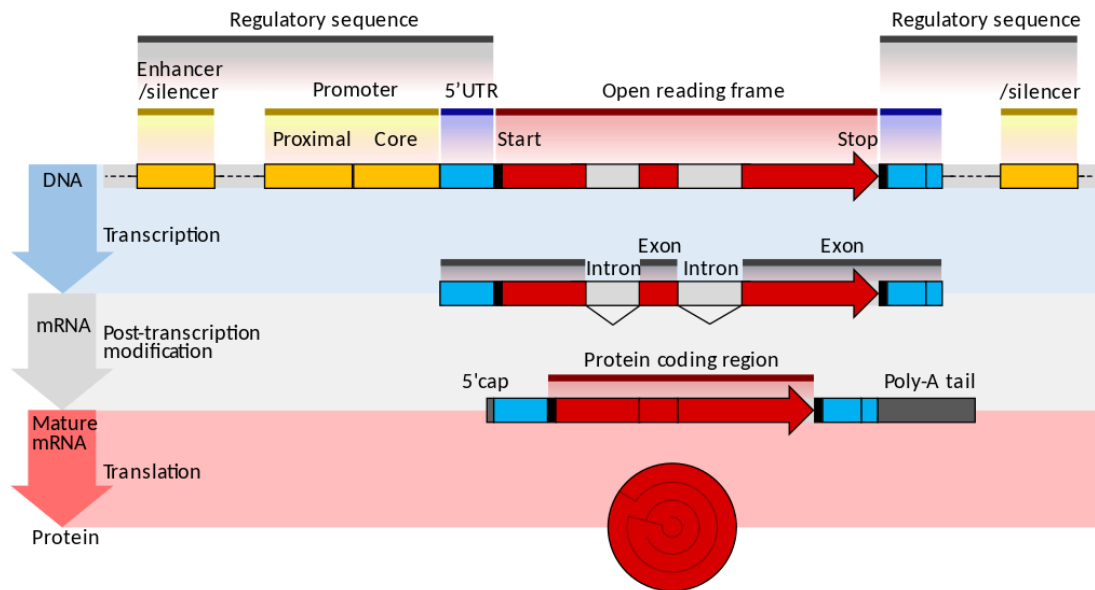
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## Key Difference - Monocistronic vs Polycistronic mRNA

The [mRNA](#) molecule carries the genetic information to produce the respective [protein](#). In all living organisms, the cell's total mRNA is translated into proteins by the process known as translation. There are several differences between [prokaryotic and eukaryotic](#) mRNA molecules. The eukaryotic mRNA is synthesized as a large precursor molecule in the [nucleus](#) which later changes. The eukaryotic mRNA encodes only for one protein and invariably represents a single gene. Hence, they are said to be monocistronic. The prokaryotic mRNA carries the sequences which encode multiple proteins. Hence they are called as polycistronic mRNA. Especially in a polycistronic mRNA, a single mRNA is transcribed from a group of adjacent genes. These groups are termed as operons such as; [Lac operon](#), galactose operon and tryptophan operon. The **key difference** between Monocistronic and Polycistronic mRNA is **that monocistronic mRNA contains genetic information of a single protein while the polycistronic mRNA carries the genetic information of several genes which are translated into several proteins.**

## What is Monocistronic mRNA?

The mRNA is known as monocistronic since it carries genetic information to translate only a single protein. Eukaryotic mRNA is monocistronic, and it contains genetic information which codes only for one protein. So they produce single protein after the translation process. Eukaryotic mRNAs are invariably monocistronic in nature.

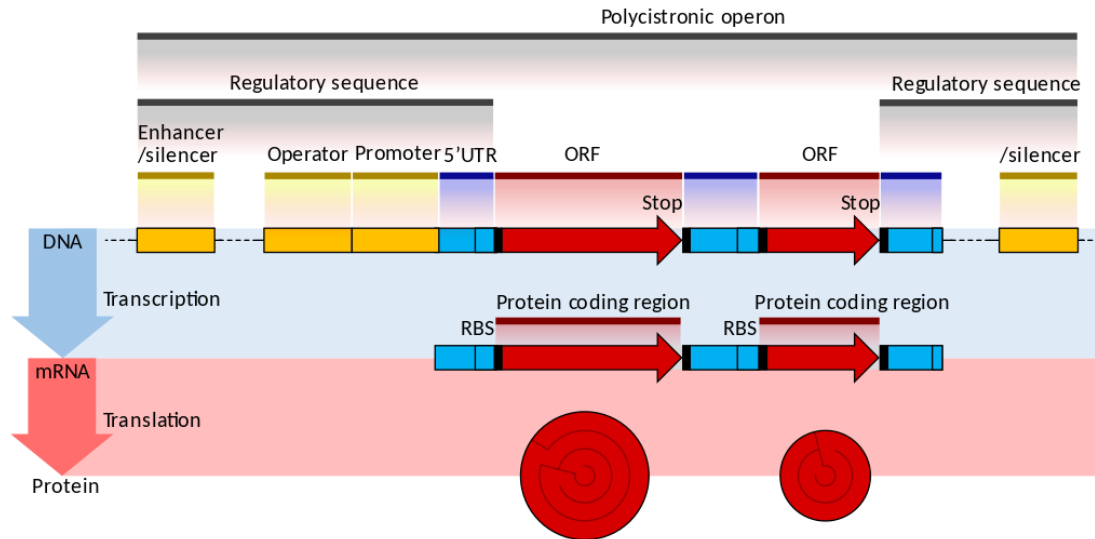


**Figure 01: Monocistronic mRNA**

The monocistronic mRNA has only a single open reading frame known as “ORF.” This open reading frame corresponds to a particular single gene transcript. The eukaryotic mRNA molecule is synthesized in the nucleus as a large precursor. Later, considerable size reduction takes place along with several other important modifications. Afterwards, it is transported to the [cytoplasm](#). So, it is synthesized and expressed in different cellular compartments. The eukaryotic mRNAs are highly stable due to post-transcriptional modifications. Their half-life could be a few hours or longer depending on the particular function.

## What is Polycistronic mRNA?

The polycistronic mRNA contains [codons](#) of a more than one cistron. The polycistronic mRNA is transcribed from a more than one gene (cistron) and has many initiations and termination codons. And also it codes for more than one protein. The polycistronic mRNA carries several open reading frames (ORFs). Each one of them is translated to a [polypeptide chain](#). Especially in the polycistronic mRNA, a single mRNA is transcribed from a group of adjacent genes.



**Figure 02: Polycistronic mRNA**

The prokaryotic mRNAs are said to be polycistronic. At the same time, the bacterial mRNA is very unstable, and they degrade closely after the translation. The [bacteria and archaea](#) have polycistronic mRNA in their cells. The polypeptides that are made from polycistronic mRNA have related functions. Their coding sequences are regulated together by a regulatory region. This regulatory region contains a promoter and an operator. The mRNAs which are dicistronic or bicistronic (encodes for two proteins) are also categorized under polycistronic mRNAs.

## What are the Similarities Between Monocistronic and Polycistronic mRNA?

- Both of them carry genetic information.
- Both are capable of producing proteins.
- Both contain uracil (U) nucleotide instead of thiamin (T) nucleotide.
- Both mRNAs are messenger mRNA types that are highly important for cellular metabolism and function.

## What is the Difference Between Monocistronic and Polycistronic mRNA?

Monocistronic vs Polycistronic mRNA	
Monocistronic mRNA is said to be monocistronic as it contains genetic information of a single protein.	Polycistronic mRNA is said to be polycistronic as it carries the genetic information of several genes which

	are translated into several proteins.
<b>Number of Proteins Coding</b>	
Monocistronic mRNA is coding for only one protein.	Polycistronic mRNA is coding for more than one protein.
<b>Number of Initiation and Termination Condons</b>	
Monocistronic mRNA is transcribed from a single gene (cistron) and has one initiation codon and one termination codon.	Polycistronic mRNA is transcribed from more than one gene (cistron) and has as many as initiation and termination codons.
<b>Presence of Eukaryotic and Prokaryotic</b>	
Monocistronic mRNA presents in eukaryotic organisms like a human.	Polycistronic mRNA presents in prokaryotic organisms like bacteria and archaea.
<b>Post-Transcriptional</b>	
Monocistronic mRNA needs post transcriptional modifications.	Polycistronic mRNA does not need post-transcriptional
<b>Stability and Lifespan</b>	
Monocistronic mRNA is stable due to post-transcriptional modifications and has more lifespan.	Polycistronic mRNA is unstable due to the absence of post-transcriptional modifications and has a shorter lifespan.
<b>Number of Open Reading Frame (ORF)</b>	
Monocistronic mRNA is having a single open reading frame (ORF).	Polycistronic mRNA is carrying several open reading frames (ORFs).

## Summary - Monocistronic vs Polycistronic mRNA

The messenger mRNA is highly important RNA molecule which carries genetic information that can produce respective polypeptide chain or protein. According to the theory of central dogma proposed by Watson and Crick, the mature mRNA is translated into a protein later that has a specific function. These proteins are regulating the cellular metabolism and other functions. Eukaryotic mRNA molecule is monocistronic since contains the coding sequence only for a single polypeptide. The prokaryotic individuals like bacteria and archaea have polycistronic mRNA. These mRNA are having transcripts of several genes of a particular metabolic process. This is the difference between monocistronic and polycistronic mRNA.

#### **Reference:**

- 1.Nivi. "The Medical Cat." Monocistronic vs. Polycistronic mRNA, 1 Jan. 1970. [Available here](#)
- 2."Messenger RNA." Wikipedia, Wikimedia Foundation, 10 Dec. 2017. [Available here](#)

#### **Image Courtesy:**

- 1.'Gene structure eukaryote 2 annotated'By Thomas Shafee - Shafee T, Lowe R (2017). "Eukaryotic and prokaryotic gene structure". WikiJournal of Medicine 4 (1). DOI:10.15347/wjm/2017.002. ISSN 20024436., [\(CC BY 4.0\)](#) via [Commons Wikimedia](#)
- 2.'Gene structure prokaryote 2 annotated' By Thomas Shafee - Shafee T, Lowe R (2017). "Eukaryotic and prokaryotic gene structure". WikiJournal of Medicine 4 (1). DOI:10.15347/wjm/2017.002. ISSN 20024436., [\(CC BY 4.0\)](#) via [Commons Wikimedia](#)

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