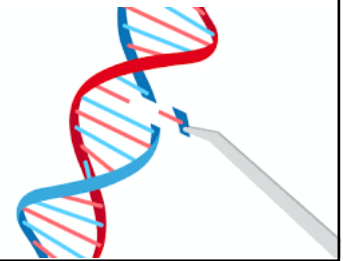


Bioinformatics I

Gene Expression

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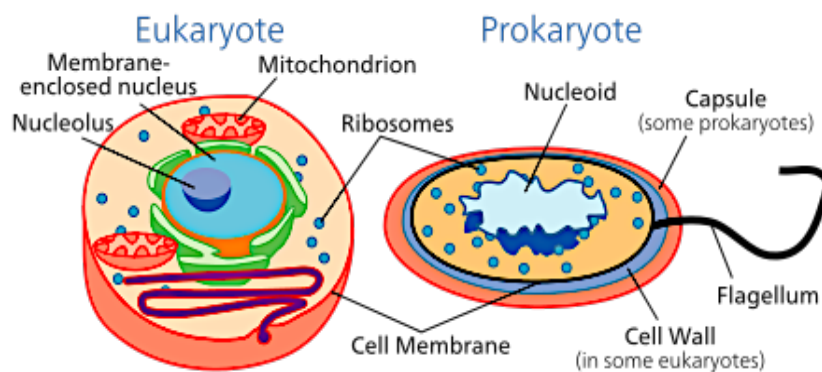
What is a gene expression?

- **Gene expression** is the process by which the information encoded in a **gene** is used to direct the assembly of a **protein** molecule.
- The cell reads the sequence of the **gene** in groups of three bases (as explained in the last lecture).
- In prokaryotic and prokaryotic, gene expression is regulated differently.
- **In prokaryotic**, Gene expression is regulated primarily at the transcriptional level.
- **In eukaryotes**, Gene expression is regulated at many levels (epigenetic, transcriptional, nuclear shuttling, post-transcriptional, translational, and post-translational).

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Eukaryotic and Prokaryote

- *They are usually larger than prokaryotic cells.*
- *It contain a nucleus and other membrane-bounded cellular compartments (such as mitochondria, chloroplasts, and endoplasmic reticulum).*



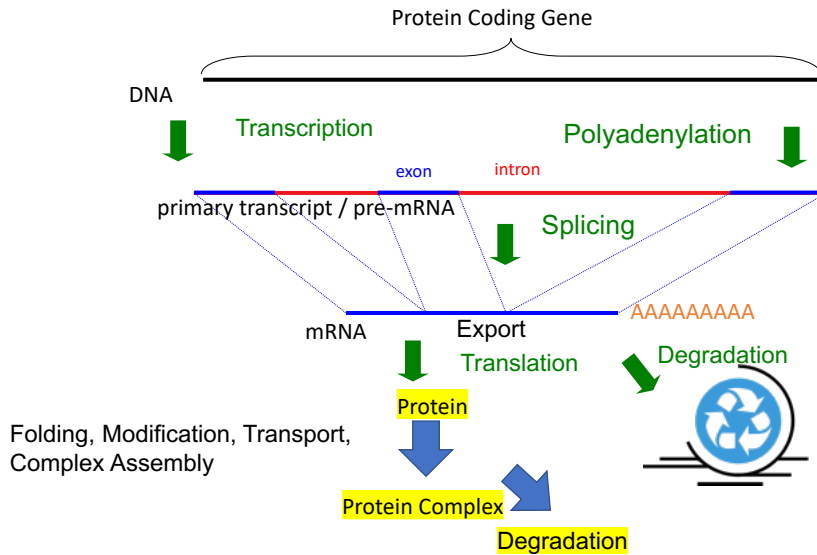
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The most differences between prokaryotic and eukaryotes genes ?

- The most striking difference is that prokaryotic gene information is encoded on a continuous DNA stretch.
- In eukaryotes, coding exons are interrupted **by noncoding introns.**
- Eukaryotic transcription of DNA to mature mRNA (containing information derived only from exons) requires several steps.
- The introns are removed during the process of splicing.
- **What is meant by the term splicing?**
- Through alternative splicing (removing and joining different introns and exons), different mRNAs and, consequently, different proteins can result from one gene

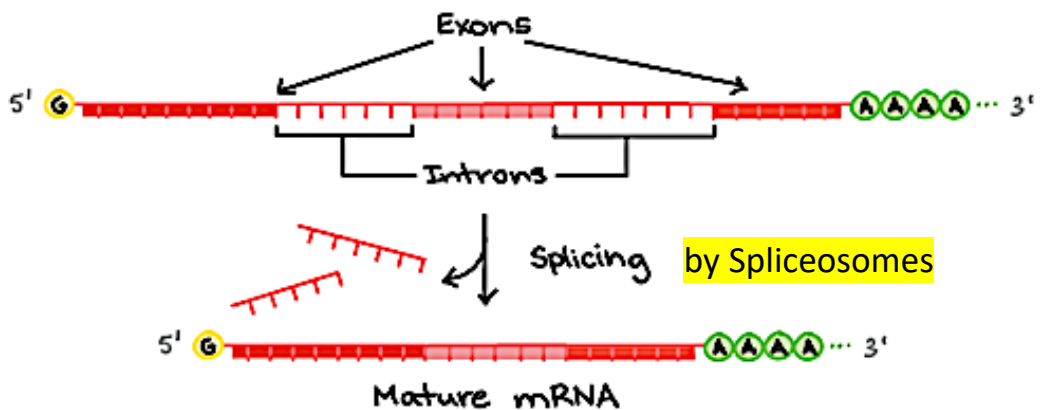
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Describe the Expression of a Typical Eukaryotic Gene?



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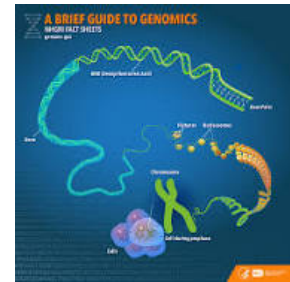
Draw the process of RNA splicing?



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What is a genome ?

- In the fields of molecular biology and genetics:
- A **genome** is the genetic material of an organism. It consists of DNA.
- **The genome includes both the genes and the noncoding DNA.**
- It also includes mitochondrial DNA and chloroplast DNA.
- The study of the genome is called **genomics**.
- So, **Genome** is the entire DNA sequence of an organism.
- Meaning: the genes and all of non-coding DNA is in between.



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Genomics

- **KEY CONCEPTS**
- **The genomes of different species vary "differ" in size and number of genes.**
- **Genes can be identified by their nucleotide sequences.**
- **Analysis of genetic data can provide information about gene function and risk of disease.**

NCBI Nucleotide Search

Search: Nucleotide for [] Go Clear

Display: GenBank Show 5 Send to Hide: sequence all but gene, CDS and mRNA features

Range: from begin to end Reverse complemented strand Features: + Refresh

1: AF193842. Reports Staphylococcus au...[gi:6110604] Links

Features Sequence

LOCUS AF193842 2631 bp DNA linear BCT 19-JAN-2000
 DEFINITION Staphylococcus aureus DNA polymerase I (polA) gene, complete cds.
 ACCSSION XP193842

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How Does Evolution Work?

It works by analysing the sequences of nucleotides in certain genes that are present in all species.

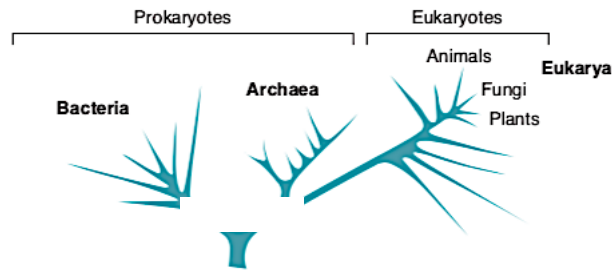


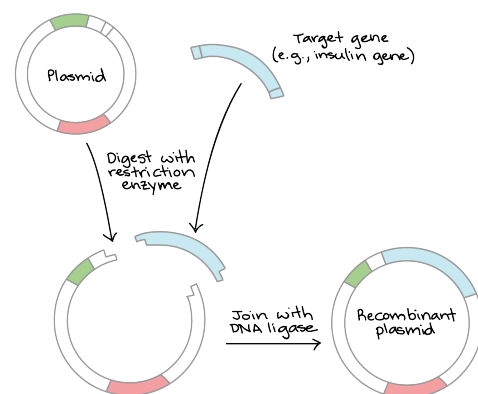
Figure 1-15 Evolutionary tree based on nucleotide sequences. This diagram reveals that the bacteria separated before the archaea and eukarya diverged. Note that the closely spaced fungi, plants, and animals are actually more similar to each other than are many groups of prokaryotes. [After Wheelis, M. L., Kandler, O., and Woese, C. R., *Proc. Natl. Acad. Sci. USA* 89, 2930–2934 (1992).]

It is possible to construct a diagram that indicates how the **bacteria, archaea, and eukaryote** are related.

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Bioinformatics involves Biotechnology

- **What is a DNA cloning:**
- It is making an identical copy for an organism.
- It refers to the process of isolating a DNA sequence of interest for the purpose of making multiple.
- In labs, vectors are used as a host to make an identical copy for a specific gene.
- Then, this gene is hosted in *E. coli* to produce protein (outside of the living body).
- In vivo or in vitro?



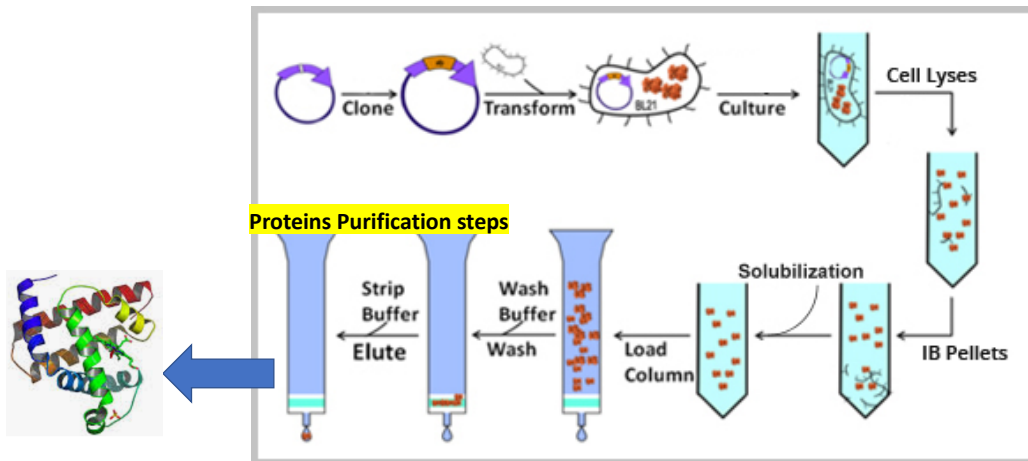
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We can do cloning in the Prokaryotic

- They are small uni-cellular organisms. No real nucleus. (usually just called **bacteria**)
Exemplified by *E. coli*, and the **archaea**.



E.coli



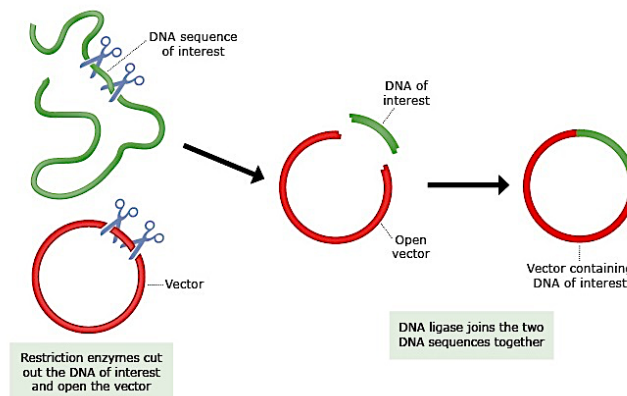
Study the Protein structure and function

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What is a genetic engineering?



- it is a removal of genes from one organism and insertion into another.



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What is recombinant DNA?

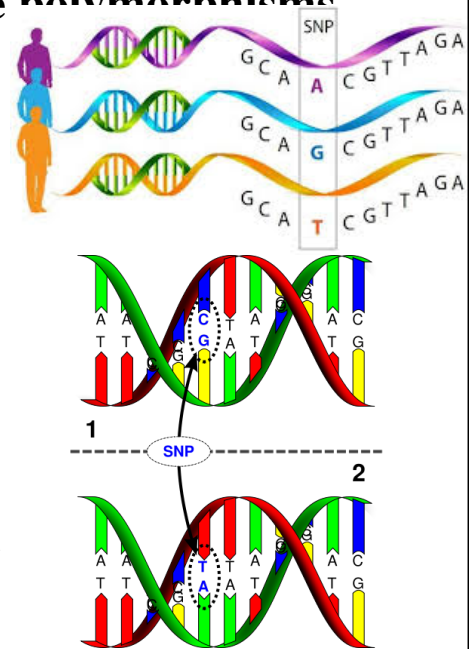
- It is DNA has been mixed with one of another species.



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What is a SNP? Single nucleotide polymorphisms

- SNPs: It is a variation in a genetic sequence that affects only one of the basic building block adenine (A), Guanine (G), Thymine (T) or Cytosine (C) in a segment of a DNA molecule and that occurs in more than 1% in the population.
- For example, at a specific base position in the human genome, the C nucleotide may appear in most individuals, but in a minority of individuals, the position is occupied by an A. This means that there is a SNP at this specific position.



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