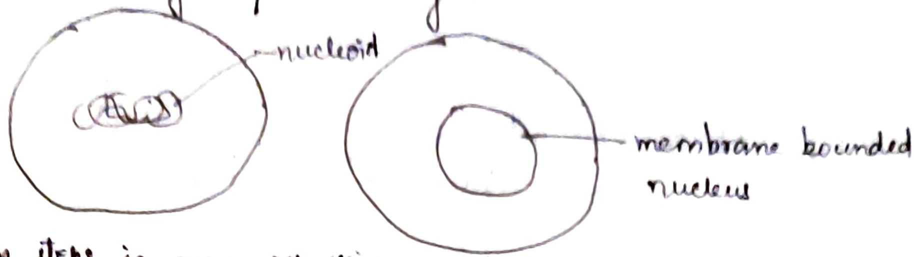
11
day

REGULATION OF GENE EXPRESSION

Prokaryotes / Eukaryotes.



Common steps in gene expression in both.

DNA
↓
RNA
↓
Protein

Eukaryotes have histone protein.

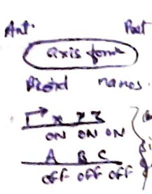
Nucleosomes are octamer of histones and basic repeating unit of chromosomes.

Histone octamer H_2A, H_2B, H_3, H_4] ×2

16A NA are wrapped around this histone octamer.

- In prokaryote there is coupled transcription & translation. But in eukaryote it is separate. Transcription in nucleus and translation in cytoplasm.

PROKARYOTES	EUKARYOTES
- Unicellular	- Mostly multicellular.
- Basically don't possess any ~~memb. bound or~~ memory	- Possesses memory.



Neurogenin is a factor which tells embryonic cells to become neural ectoderm.

→ CpG is mostly ~~(90%)~~ present in promotor region, but least in coding region. Cytosine present in CpG cond. are 50% methylated.

- Prokaryotes & eukaryotes both have certain regulatory region in upstream.

[ ]
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- These operons are not exclusive to prokaryote but also present in some eukaryotes (least)
  - e.g. Sea urchin
- Archebacteria is not a prokaryote but it is separate from both pro- & eukaryotes.

Different steps of Regulation

① CHROMATIN STRUCTURE:

Chromatin — [Heterochromatin — more compacted — get more stained.
[Euchromatin

Chromatin type is decided by
1) Status of DNA — methylation & demethylation
2) " " histone —

Importance of methylation—
5-Azacytidine (cytidine analogue) can be incorporated in DNA but can't be methylated. Fibroblast cells grown in this medium get differentiated into muscle cell. Normally a gene MyoD remain inactivated. But in this situation this get activated and changes fibroblast in muscle cells..

→ **Regulation by histone modification**—

Structured domain — core of histone
Unstructured " — histone tails protruding out of core.

These histone tails are subjected to different kind of modification.

a) Acetylation — mostly lysine (K) residues.
b) Methylation
c) Phosphorylation
d) Sumoylation
e) Ubiquitinization

All these modification, occurs at specific residues and depending upon residue & posⁿ they may lead to gene expression or silencing.

- Normally acetylation lead to gene expression but exceptionally these lead to gene silencing also.
e.g

(2) Initiation of Transcription

2 sets of genes are there in entire genome

(1) House keeping genes — Always active and do fn of survival. And maintainance of basic cellular transcriptional machinary is always there.
- Thus they require very less amount of modification.
e.g. Mitochondrial gene

(2) Tissue specific genes — Required by particular tissue to carry on fn of particular cell types.

(3) Conditional-gene — Gene activated at specific condition.
eg. HSP gene. These genes are turned on when specific temp. prevails.
Temperature variants are mutants of this gene.
In Drosophila, there are HSFs (factors) present in cytoplasm. When temp. ↑es, the trimerise and enter in nucleus and bind to promoter region of HSP gene and activate them.
- HSP 70 — Response to temp. stress.
- HSP 70 Cognate — It is a type of molecular chaperon & operate in folding & unfolding. Expressed in normal cell.
- HSP 90 required for nuclear transport.

(3) mRNA processing —

- Splicing
- 5' methylation (capping)
- 3' poly A ~~capping~~ tail

Maskin — a protein which masks mRNA & prevents from getting translation. It is generally inactive. ~~These mRNA~~

- This Maskin protein is required in early embryonic stage of development. ~~If not used get~~ These come from mother single in form of mRNA and if not used, get degraded.

3' UTR region determines the stability of mRNA.

- All mRNA are not dispersed in whole cytoplasm but remained confined to specific region and get translated when required. Their mRNA transport to specific region is carried by microtubules & filaments and some specific proteins ~~RNA~~ are required.

eg. Cargo protein.