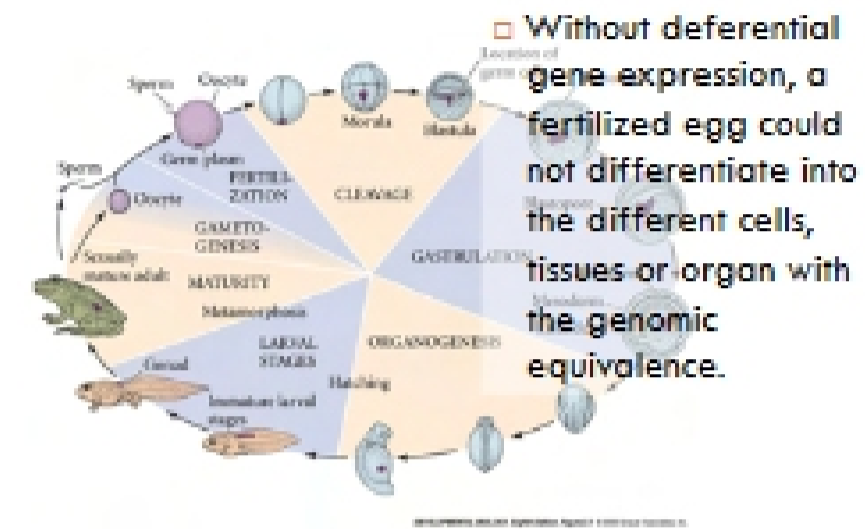


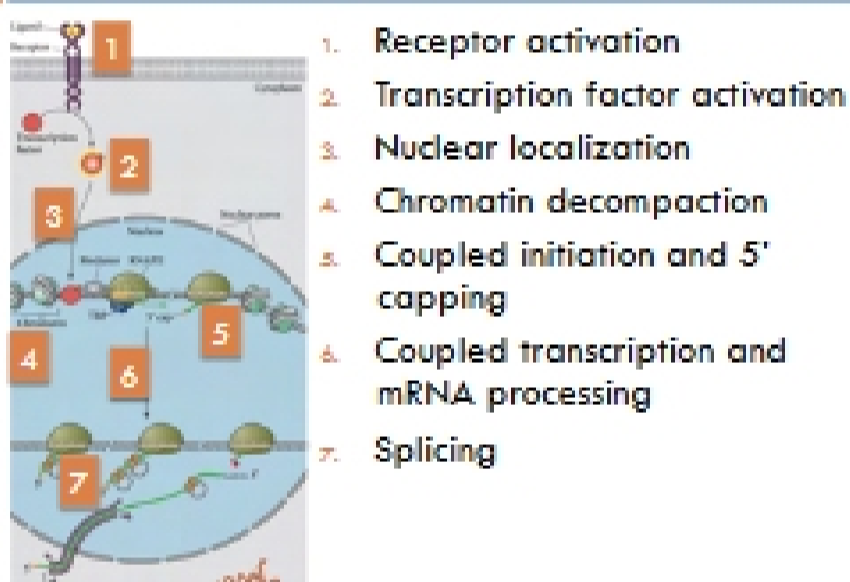
## CHAPTER 5, THE PARADIGM OF DIFFERENTIAL GENE EXPRESSION

ZOO3603C 9/10/2009 Satomi Kohno

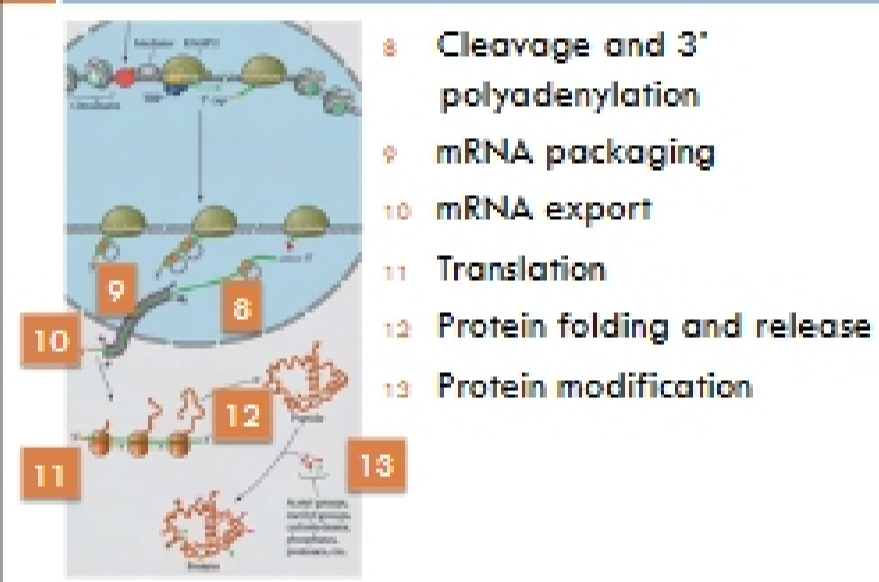
## Developmental history of the leopard frog, *Rana pipiens*



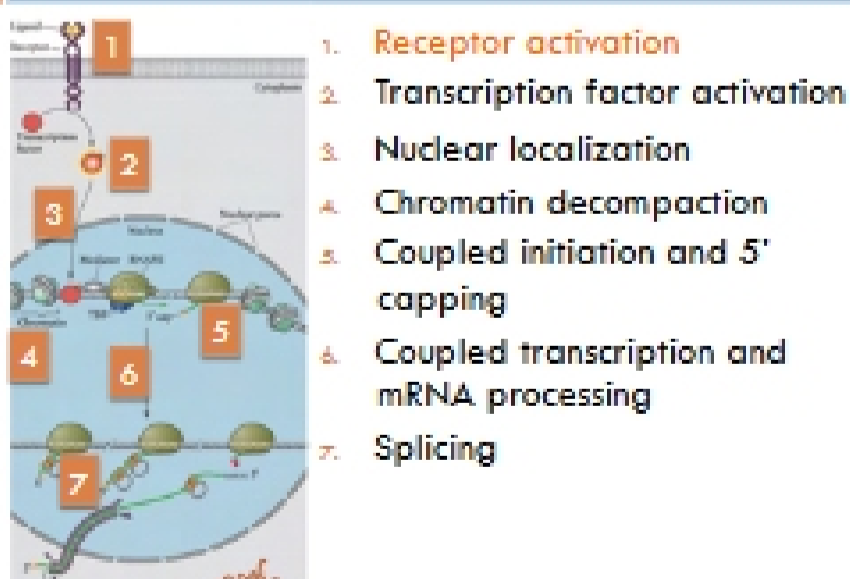
## An integrated account of gene expression I



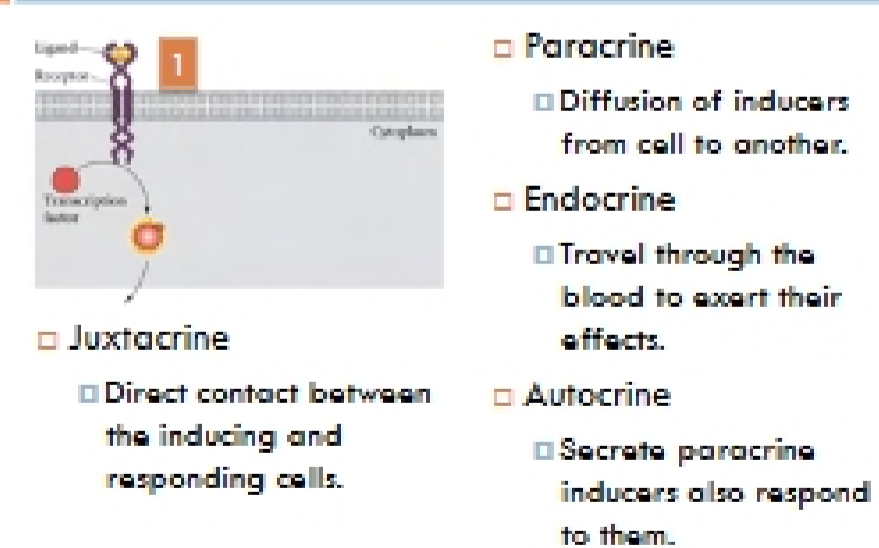
## An integrated account of gene expression II



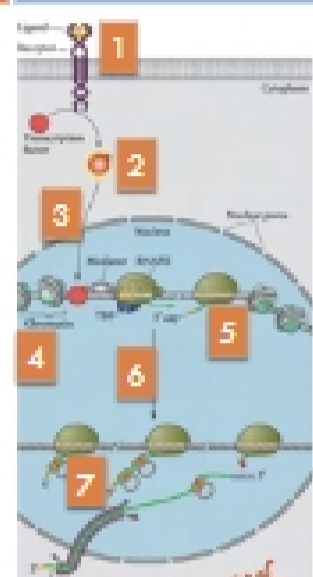
## An integrated account of gene expression I



## 1. Receptor activation

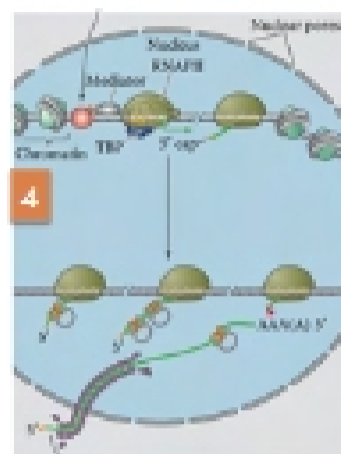


## An integrated account of gene expression I



1. Receptor activation
2. Transcription factor activation
3. Nuclear localization
4. **Chromatin decompaction**
5. Coupled initiation and 5' capping
6. Coupled transcription and mRNA processing
7. Splicing

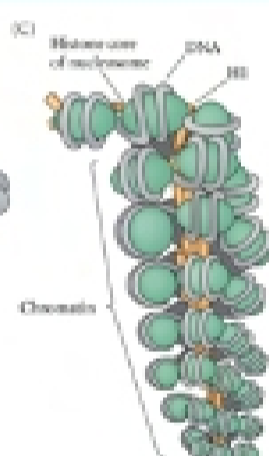
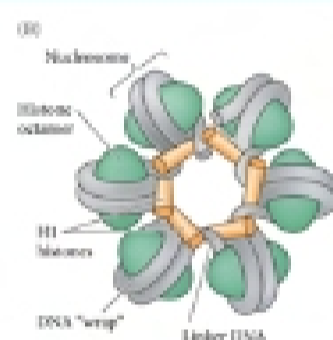
## Chromatin decompaction



Mechanical and chemical modifications on the chromatin regulate gene expressions.

- Dosage compensation
- Methylation
- Insulator

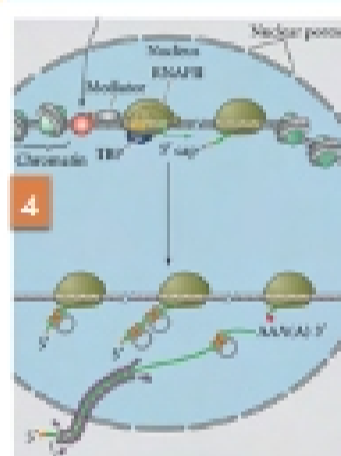
## Nucleosome and chromatin structure



Chromatin: a complex of DNA and protein, histone

Heterochromatin: highly coiled chromatin; inactive for transcription.  
Euchromatin: normal chromatin; active for transcription.

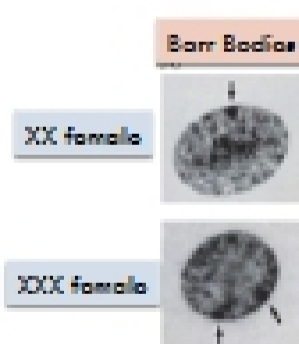
## Chromatin decompaction



Mechanical and chemical modifications on the chromatin regulate gene expressions.

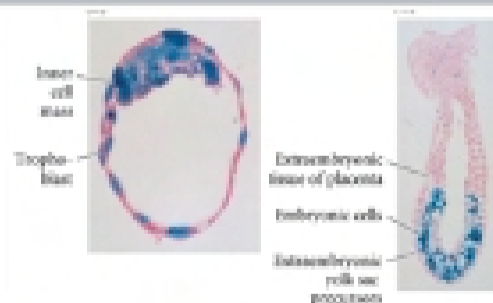
- **Dosage compensation**
- Methylation
- Insulator

## Inactivation of a single X chromosome in mammalian XX cells



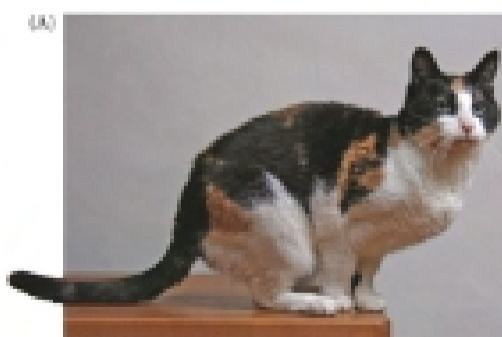
Heterochromatic X chromosome becomes a Barr Body.

X chromosome contained a lacZ making -galactosidase. If this X activated, the cells would become blue.



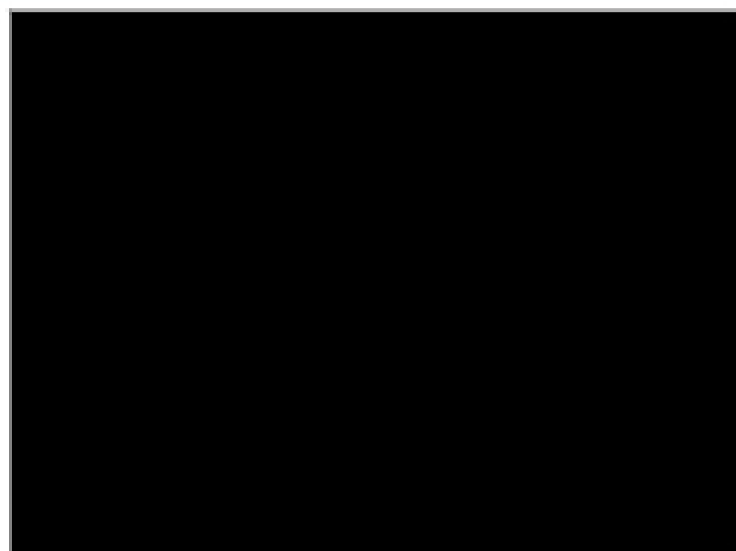
X chromosome inactivation: imprinting Initiated by XIST?

## X chromosome inactivation in mammals

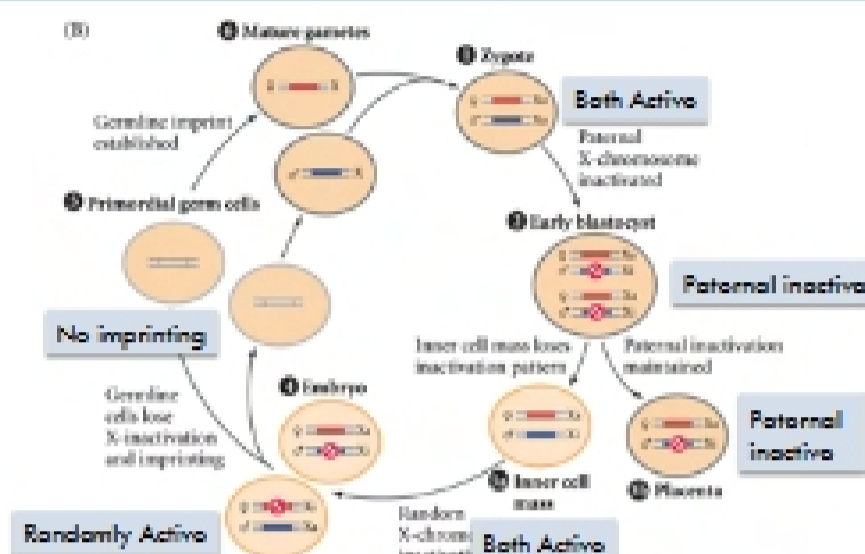


X chromosome contain an orange allele for pigmentation gene, and the other X chromosome bear a black allele for that pigmentation gene.

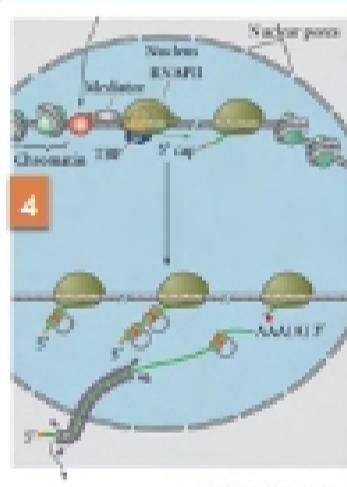
## X chromosome inactivation in mammals (Part 1)



## X chromosome inactivation in mammals



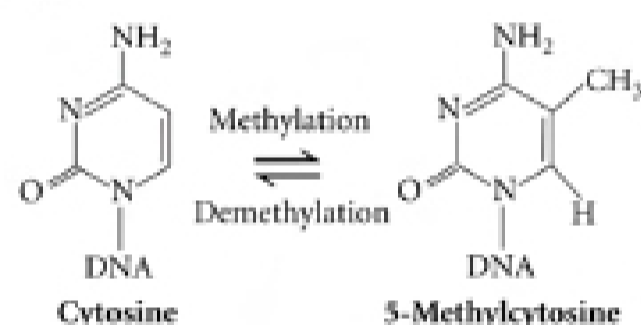
## Chromatin decompaction



Mechanical and chemical modifications on the chromatin regulate gene expressions.

- Dosage compensation
- Methylation
- Insulator

## DNA methylation

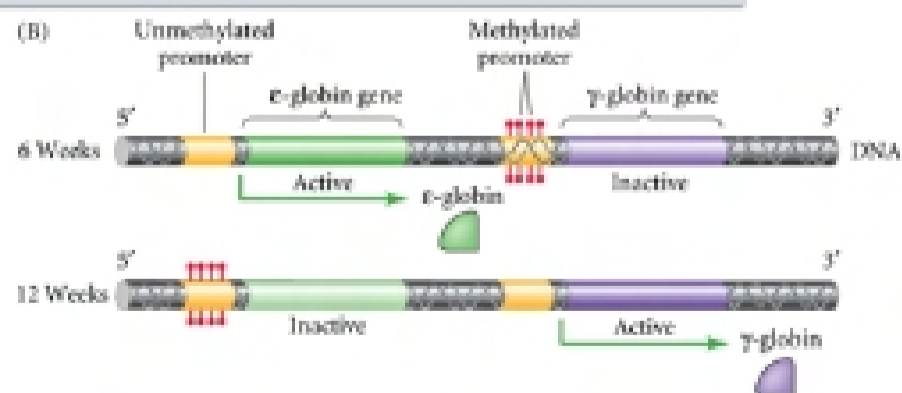


Methylation stabilizes nucleosomes and prevents transcription factor from binding.

## Methylation of globin genes in human embryonic blood cells

Methylation pattern changes during development.

DNA methylations are an enhancer or promoter region: genomic imprinting



## Chromatin modification induced by DNA methylation

- Histone H3
  - Inactive = Methylation + Active = Acetylation
- Methylation of histone H3 increases the nucleosome's stability.
  1. MeCP2 binds to methylated regions of DNA and histone deacetylase.
  2. EZH2 binds to DNA methyltransferase which would methylate DNA and histone.
  3. Histone H1 binds to methylated regions of DNA.