CONCEPT: THE EPIGENETIC CODE

Chromatin Structure

● Chromatin exists in two states: *Euchromatin* and *Heterochromatin*

□ **Euchromatin** is a less _____ DNA structure

- Allows for the packaged DNA to be accessible to other proteins

□ **Heterochromatin** is a more condensed DNA structure

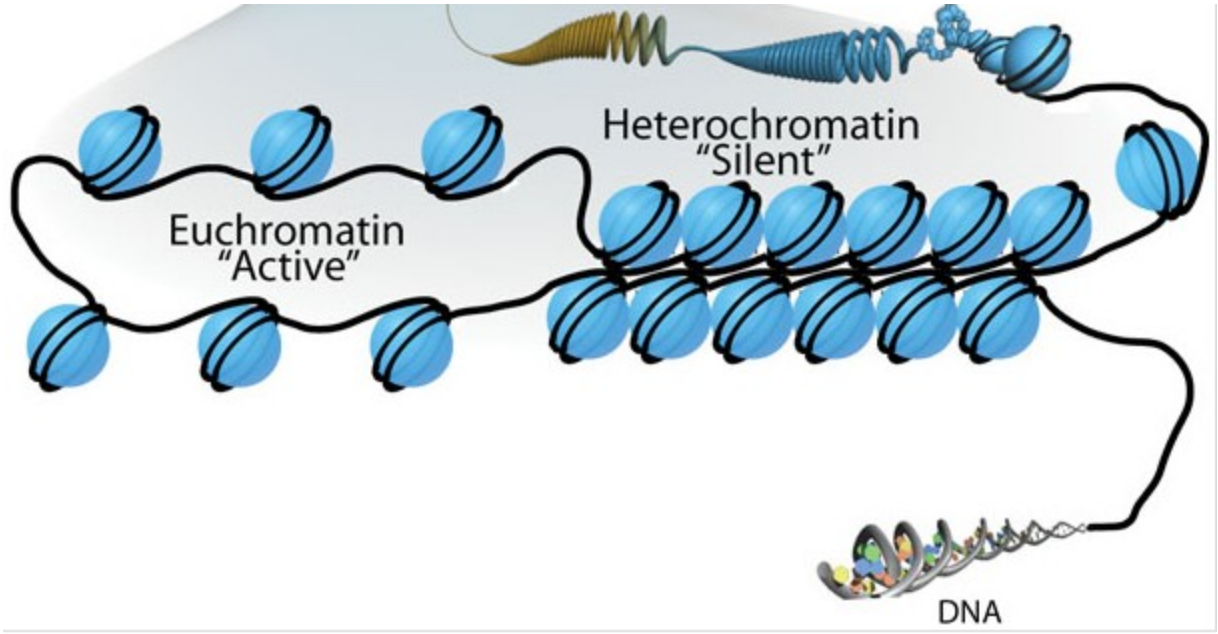
- Genes present in heterochromatin areas are not expressed, therefore it contains few genes

- Found mainly in centromeres and telomeres

□ The **zone of inactivation** describes restriction of gene expression of genes placed near heterochromatin

- Due to **position effects**, the activity of a gene depends on relative location to heterochromatin

EXAMPLE: Structure of euchromatin and heterochromatin



Histone Protein Modifications

● Histone proteins control the packaging and condensation of the DNA

□ Each histone protein contains an N-terminal _____

- Amino acids on this tail can be covalently modified to effect condensation of the DNA

□ **Acetylation** (C_2H_3O) and **Methylation** (CH_3) are the two most common modifications

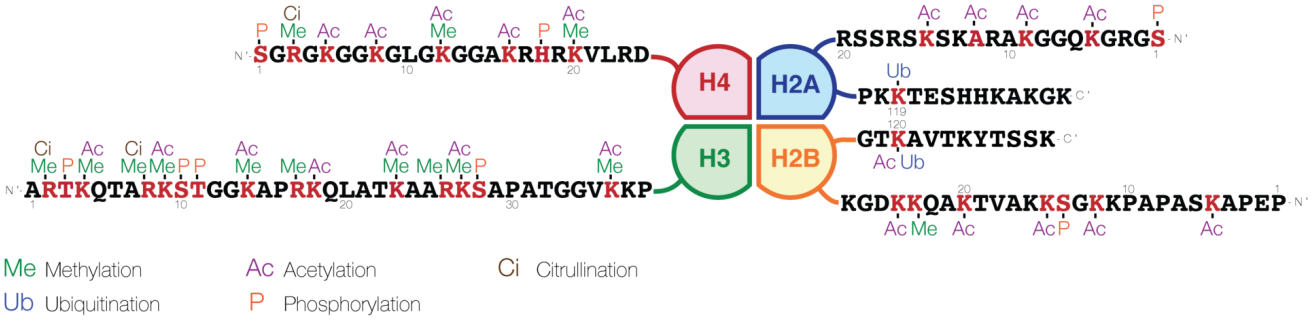
- Acetylation removes the _____ charge from the histone and loosens chromatin structure

- Methylation tightens chromatin structure and prevents acetylation

□ Occasionally a chain reaction can initiation a long linear chain of similar histone modifications

- Eventually stopped by *barrier sequences* which separate condensed and noncondensed chromatin

EXAMPLE: Histone modifications in a nucleosome core



Reading the Epigenetic Code

● Reading the **epigenetic code** (histone modification code) is an extremely difficult process

□ Each nucleosome has a different _____ of modification, which is carefully controlled

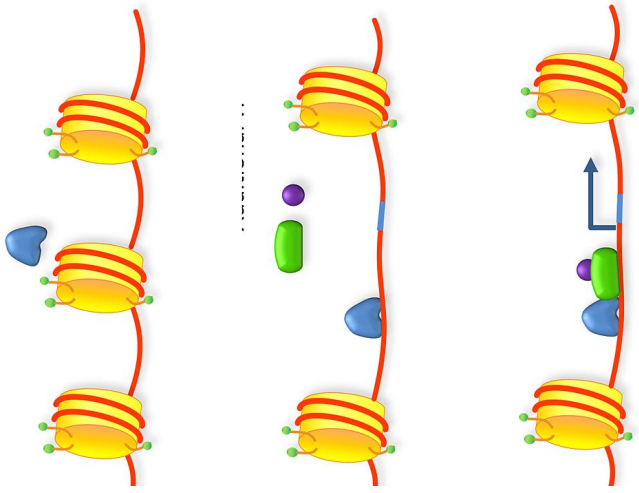
- Once modified, they can attract other proteins

- These modifications are constantly changing to adapt to the cells needs

□ **Chromatin remodeling complexes** use ATP energy to change the position of DNA on a nucleosome

- Allow for specific sequences to become more or less condensed

EXAMPLE: Histone remolding allows for gene access



● **Epigenetic inheritance** is the process of inheriting chromatin structure

□ Histone modifications are passed to daughter cells

- Amino acids on this tail can be covalently modified to effect condensation of the DNA

□ This inheritance allows for **cell memory** which is _____ inheritance

PRACTICE:

1. Which of the following terms is associated with condensed chromatin?
    a. Acetylation
    b. Euchromatin
    c. Heterochromatin
    d. Cell memory

2. Which of the following histone tail modifications is most likely to cause closed chromatin?
    a. Acetylation
    b. Methylation
    c. Phosphorylation
    d. Ubiquitination

3. True or False: The position of nucleosomes on a region of DNA can never change.
    a. True
    b. False

4. True or False: Histone protein modifications can be inherited.
    a. True
    b. False