Epigenetics Primer

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Epigenetics Retreat

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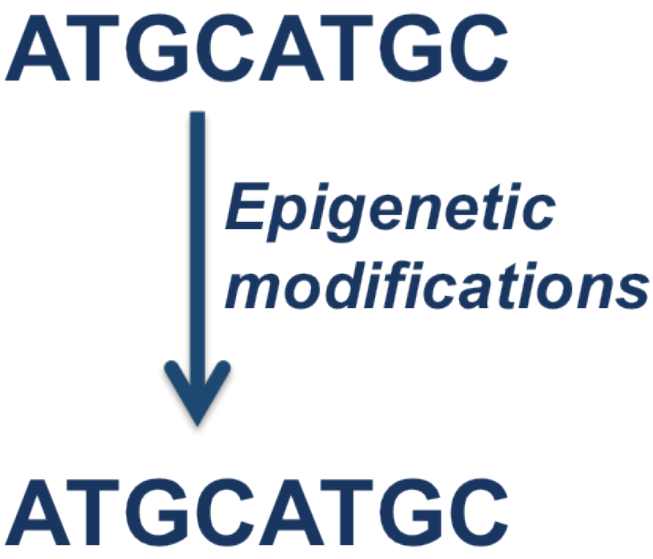
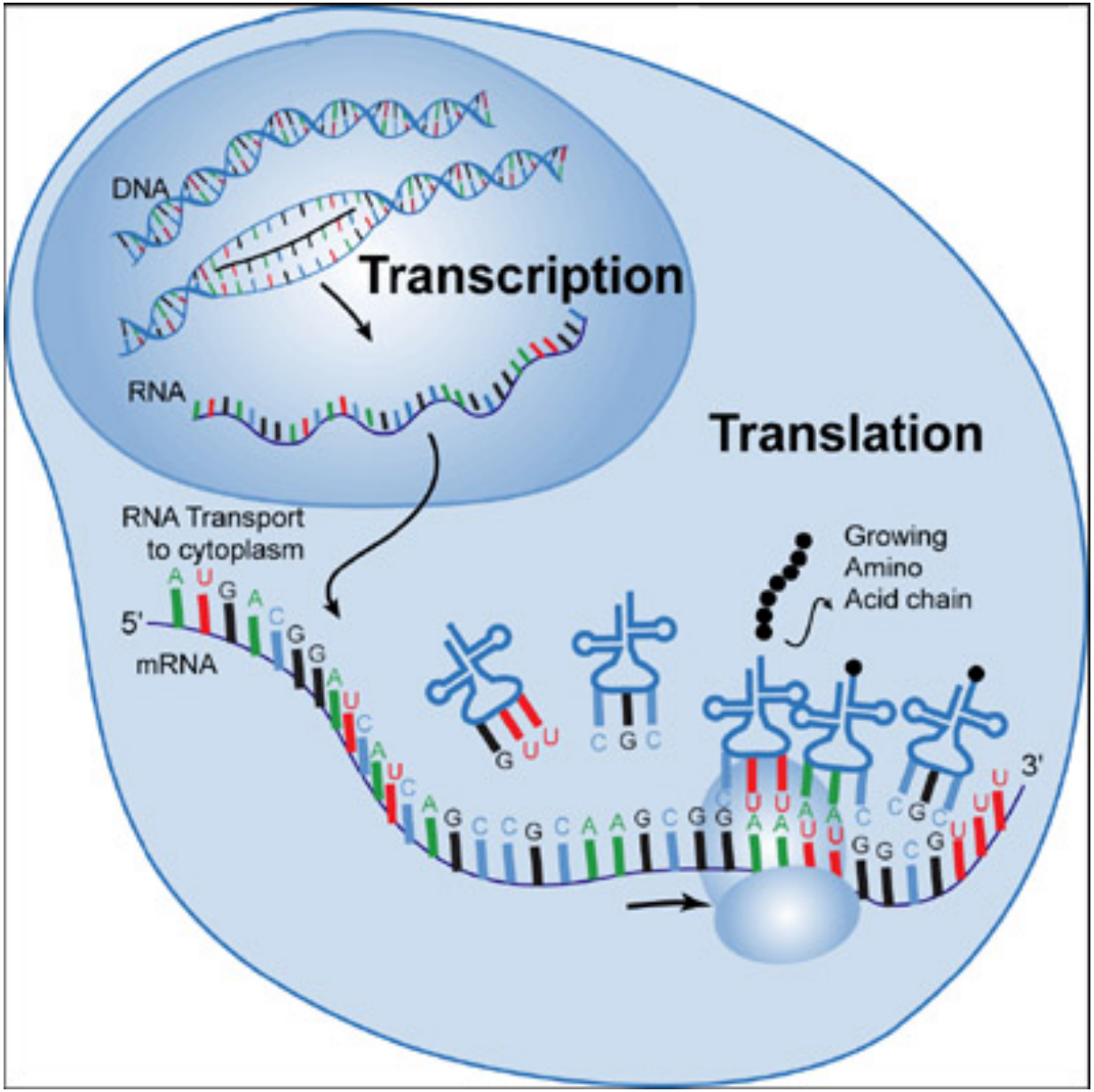
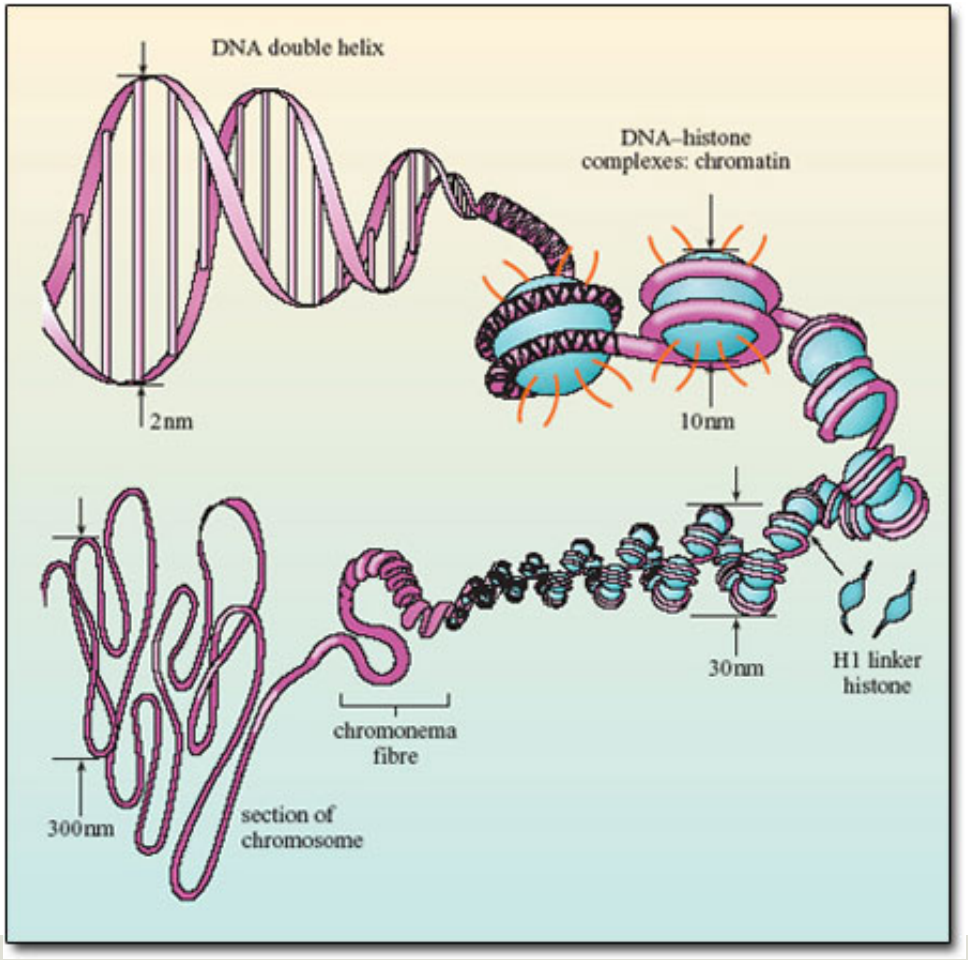
Epigenetics …

- Does not change the sequence of DNA



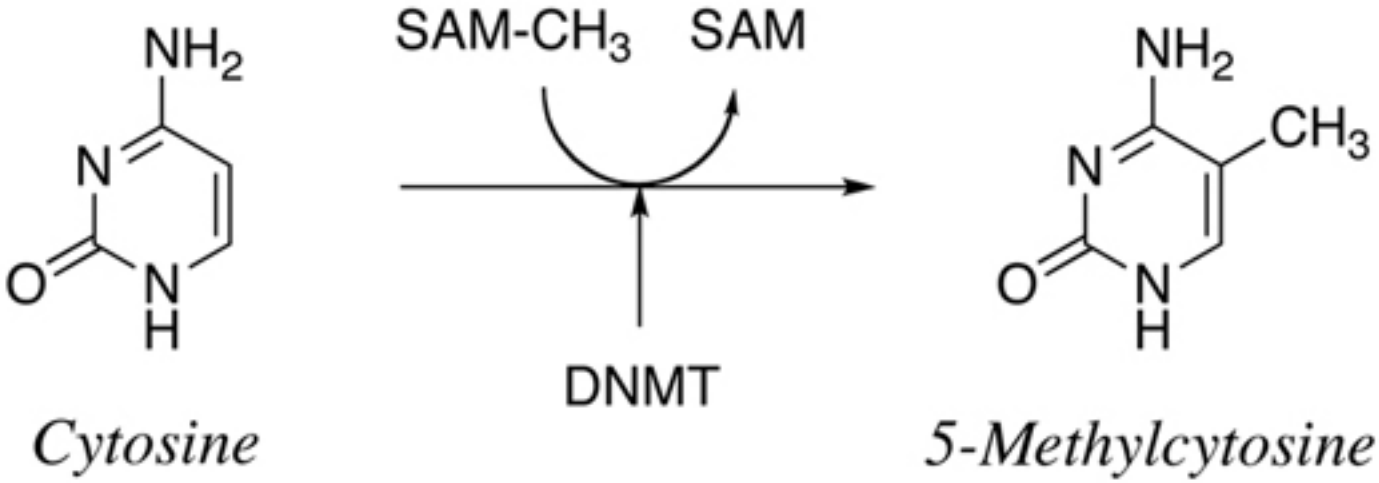

DNA
Transcription
RNA
Translation
RNA Transport
to cytoplasm
5'
mRNA
Growing
Amino
Acid chain
3'

- Modulates access of a gene to the cell's transcription machinery
- Controls gene expression

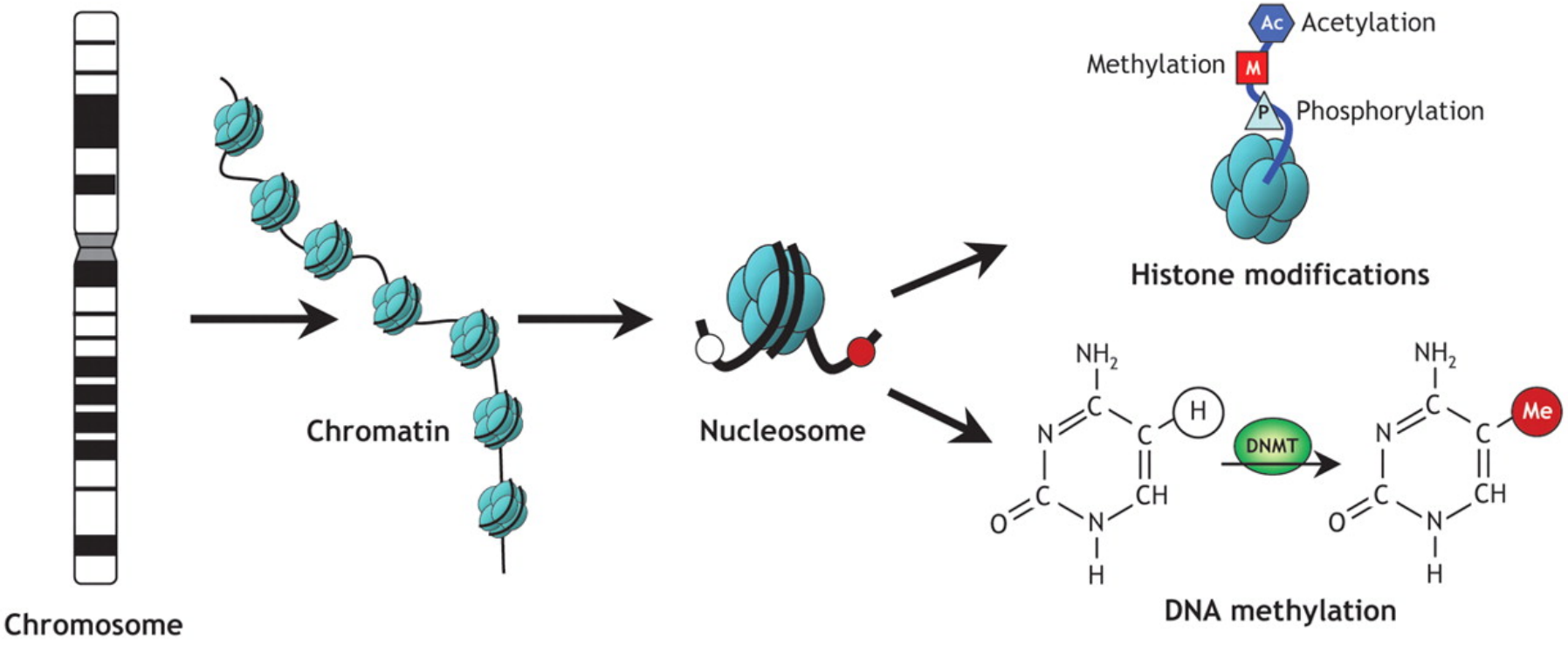


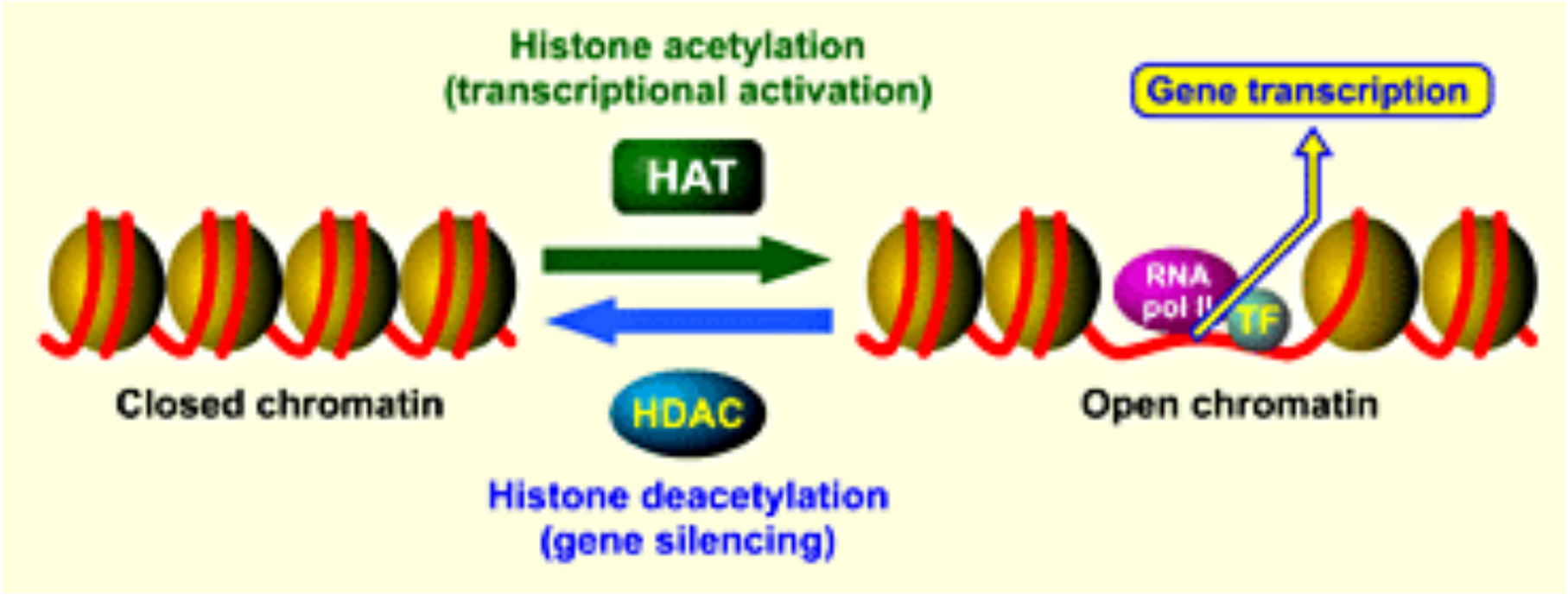
Types of Epigenetic Modifications

- DNA methylation
  - CpG residues



Histone modifications

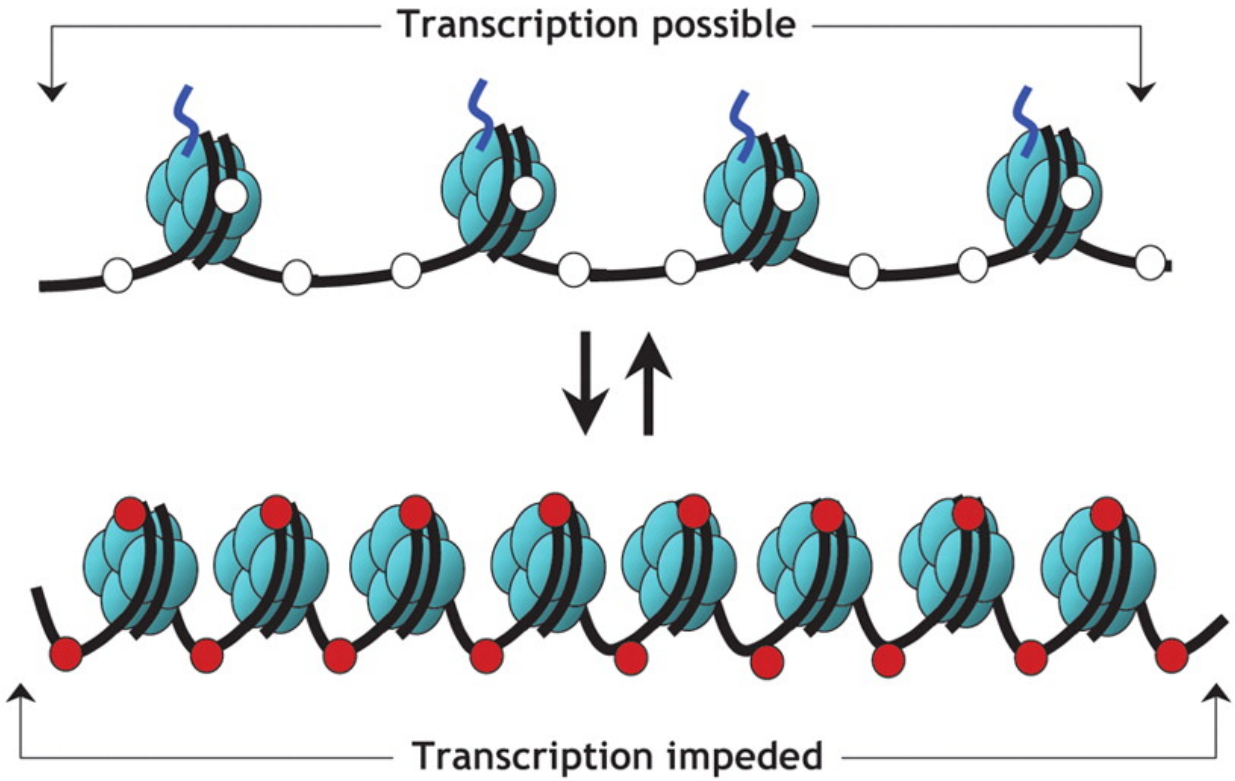



Histone acetylation
(transcriptional activation)
HAT
Gene transcription
RNA
pol II
TF
Closed chromatin
HDAC
Open chromatin
Histone deacetylation
(gene silencing)

Controlling Gene Expression

Gene "switched on"
- Active (open) chromatin
- Unmethylated cytosines (white circles)
- Acetylated histones

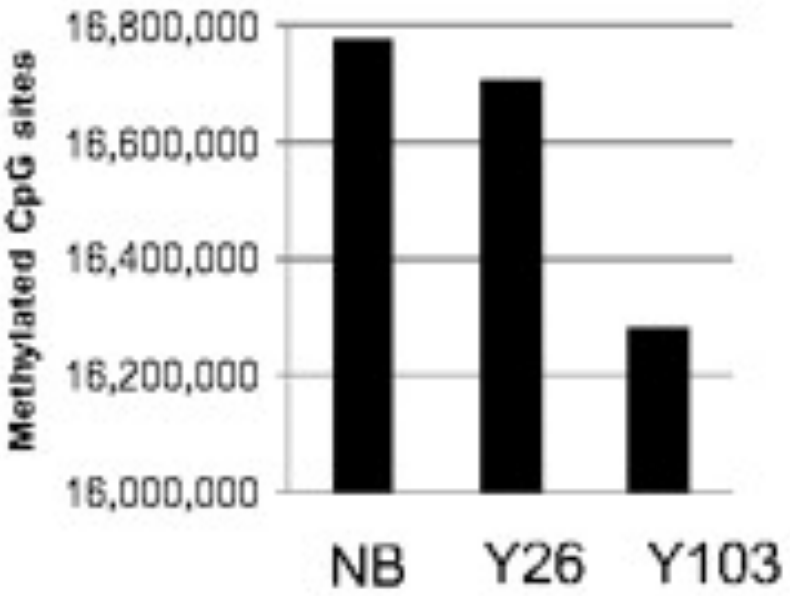
Gene "switched off"
- Silent (condensed) chromatin
- Methylated cytosines (red circles)
- Deacetylated histones

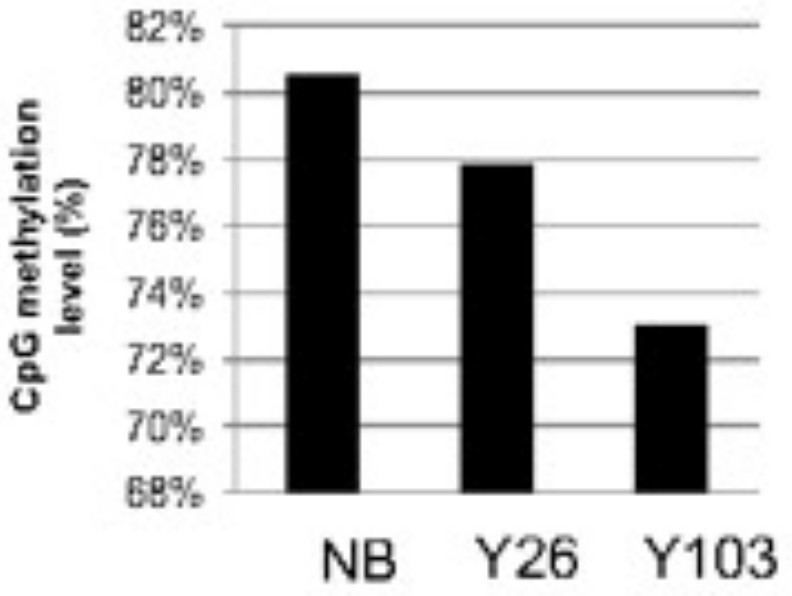


Heritability and Environment

Epigenetics and Aging

- Reduced methylation in centenarian





Heyn H et al. PNAS 2012;109:10522-10527

- Also changes in the pattern of methylation
  - Promoters of tumor suppressor genes: higher methylation
- Unclear: reason for methylation loss
  - DNA methyltransferases?
  - Reduced folate consumption?

Epigenetics and Cancer