



DNA

DNA Methylation in Development

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DNA methylation is one of many epigenetic mechanisms that regulate gene expression in the human body. From the view of epigenetics, there are two phases of development, one for germ cell development and another for embryo development. This review will discuss the basic mechanism of methylation, its role in gene expression, and the role of methylation in embryonic reprogramming. Methylation of genes is very critical to embryo development and should be explored further in order to increase our understanding of development.

Key Words: DNA methylation, Epigenetics, Development

Epigenetics DNA 가 DNA S-adenosyl-me-
 , DNA (methyltransferases)가
 (chromatin) 가 DNA thionine 가 .
 CpG (dinucleotide)
 DNMT1, DNMT3A, DNMT3B 3가
 (sumoylation) . epigenetic X
 . DNA
 (genome imprinting) (heterochromatin) . DNA
 (dosage) , ,
 (transposable element) X ,
 epigenetic DNA
 . 3-5% 5 가
 1) 70-80%가 CpG
 2) .
 1. DNA DNA (methylation) 5' DNA CG
 가
 CpG CpG (CpG islands) .
 CpG
 (deamination) (thymine) DNA
 CpG가

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가 500 CpG , GC 0.65가 CpG 70% 5' CpG/ 55% CpG가 (transcription) 가 (transcription factor)가 , , , CpG 가 , CpG 9). CpG 가 , CpG 가 DNA DNA X 3). DNA CpG CpG 가 CpG 4). CpG 가 10-12).

2. DNA

가 , DNA DNA DNA DNA DNA 가 (promoter) 가 , X- 1) (Transcription Factor) CG CpG 13, 14). 가 c-myc CTCF c-myc (gel shift assay) DNA 가 c-myc 14). CTCF H19/lf2 CTCF 가 Igf2 8). DNA (fibroblast) 가 CTCF 가 CTCF 15).

3. DNA

DNA 가 DNA 가 (nucleosome occupancy) 가 DNA 가 (somatic) DNA DNA

H3K4 H3K4(histone H3 lysine) 2
 4) 가 가 ¹⁶⁾ H3K4
 CpG 가 가
 17-20) 가 ^{27, 28)}
 가 (sister chromatids)
 3) CpG
 DNA CpG 가 DNA
 CpG (methyl CpG binding proteins (MBPs)) DNA
 MBP MBD1, MBD2, MBD3, MeCP2, 가 DNA DNA
 Kaiso 가 가 ²¹⁾ MBP 가 DNA DNA
 (histone deacetylase)가 1 (DNMT1) DNMT1 DNA 가
²²⁻²⁴⁾ CpG 가 ²⁹⁾ DNMT1
 4) 가 DNA
 CpG 가 ^{30, 31)} DNA 2
 RNA II가 DNA 가 가
²⁵⁾ 4 가
 4. 8
 2 (blastocyst-stage embryos)
 가 (inner cell mass)
 (diploid) DNA (somatic methylation)
 (replication) (extraembryonic lineage)
 가 Bisulfite (trophoblast) ^{32, 33)}
²⁶⁾ 가
 embryo) (pronuclei) (polyspermic) 가
 가
³⁴⁾ Prader-Willi/Angelman , Beckwith-Widerman
 2 가
 (two-cell embryo stage) epigenetics
 가

epigenetics

가

epigenetics

가

DNA

genetic

. Epigenetics

가

epi-

가

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