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STRATEGIC INTERUNIVERSITY COOPERATION TO IMPROVE RESEARCH ABILITIES FOR Ph.D. STUDENTS FOR HIGHER EDUCATIONAL QUALITY -QUALITAS-

Cluj-Napoca, Romania

QUALITAS – Course
“RNA epigenetics in cancer”

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Basic understanding of genetic inheritance

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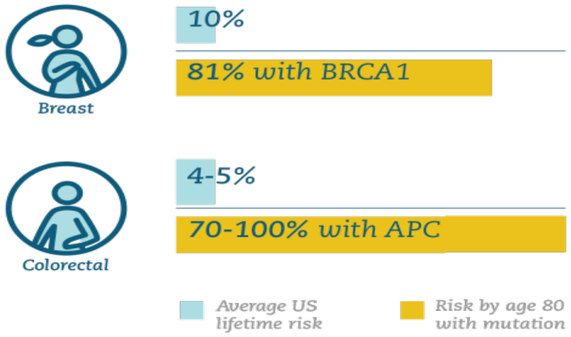
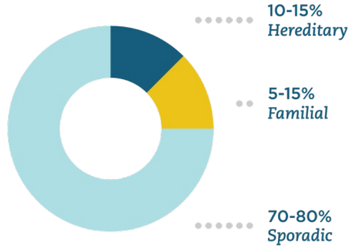
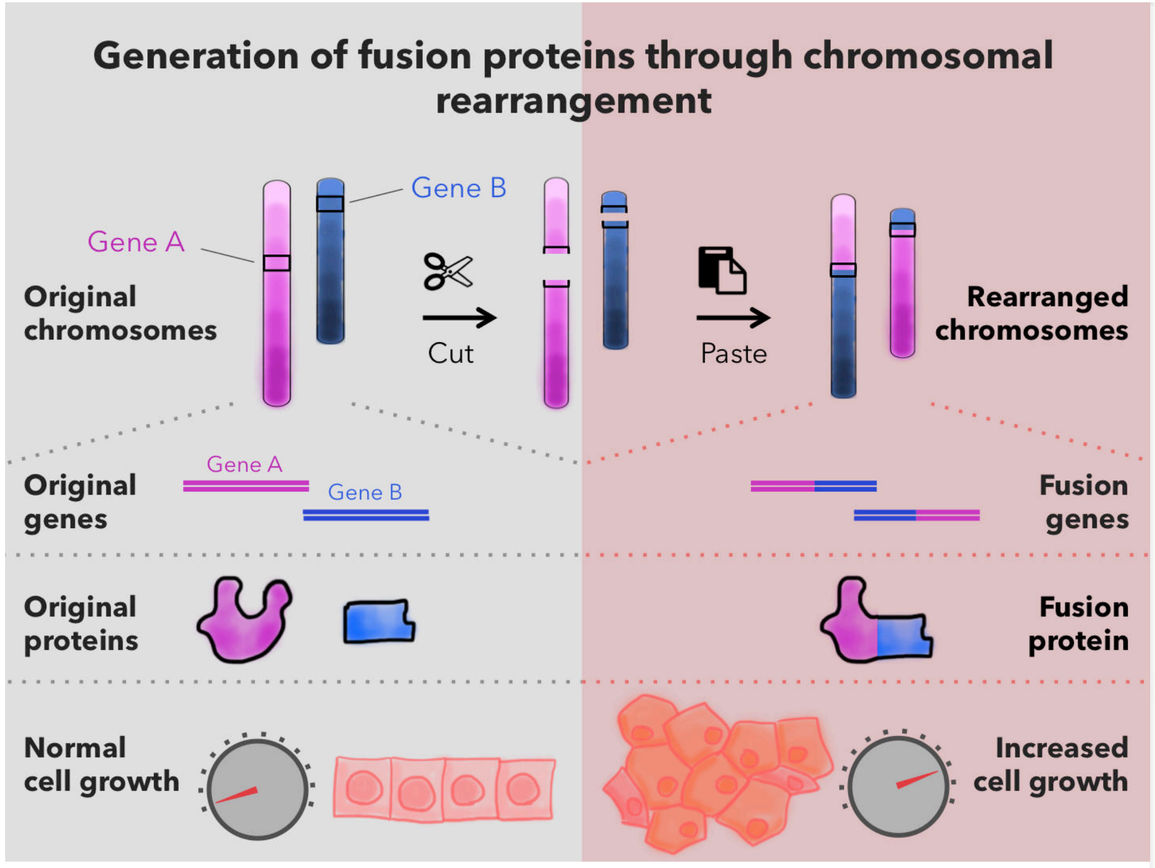
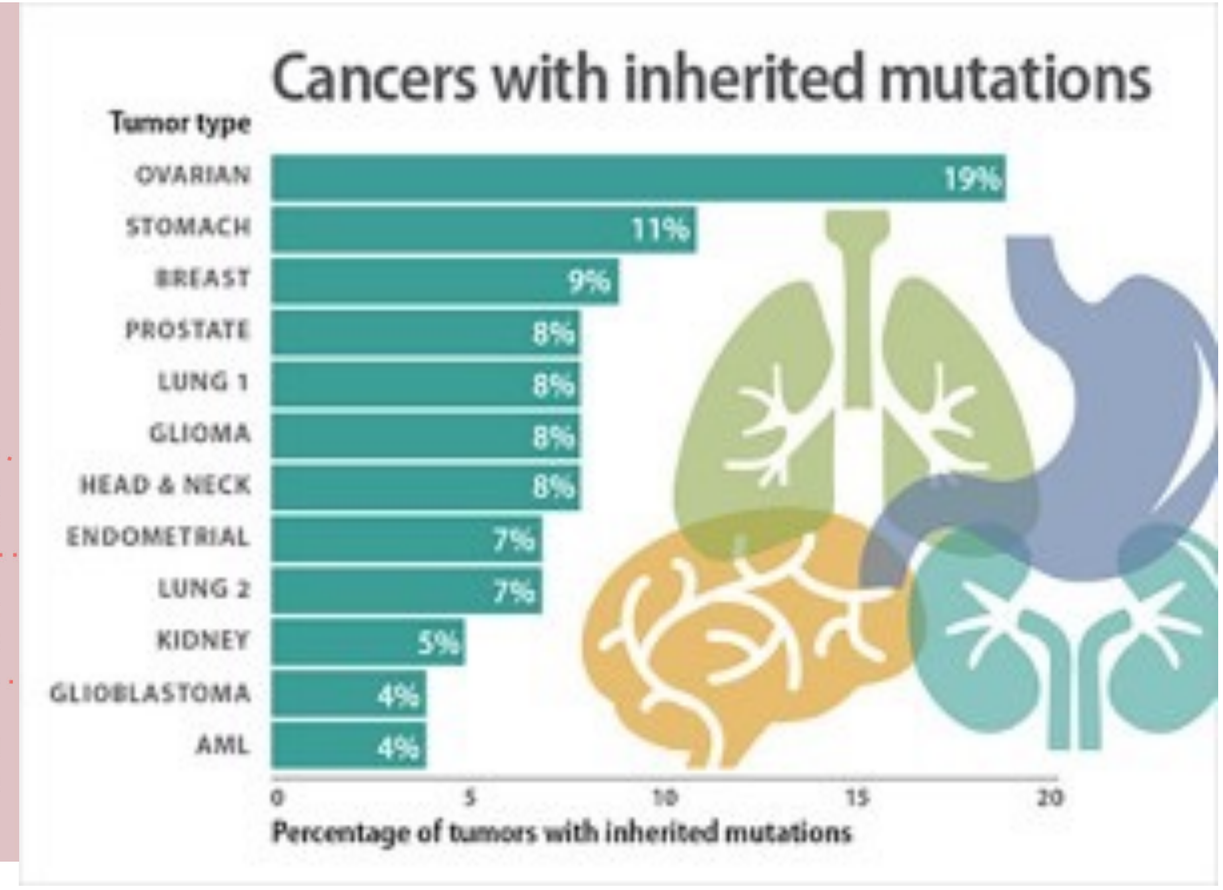

Breast
10%
81% with BRCA1
Colorectal
4-5%
70-100% with APC
Average US lifetime risk
Risk by age 80 with mutation


10-15%
Hereditary
5-15%
Familial
70-80%
Sporadic


Generation of fusion proteins through chromosomal rearrangement
Gene A
Gene B
Original chromosomes
Cut
Paste
Rearranged chromosomes
Original genes
Gene A
Gene B
Fusion genes
Original proteins
Fusion protein
Normal cell growth
Increased cell growth


Cancers with inherited mutations
Tumor type
OVARIAN 19%
STOMACH 11%
BREAST 9%
PROSTATE 8%
LUNG 1 8%
GLIOMA 8%
HEAD & NECK 8%
ENDOMETRIAL 7%
LUNG 2 7%
KIDNEY 5%
GLIOBLASTOMA 4%
AML 4%
0
5
10
15
20
Percentage of tumors with inherited mutations

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Overview of epigenetic inheritance “coded by” proteins, DNA and RNA

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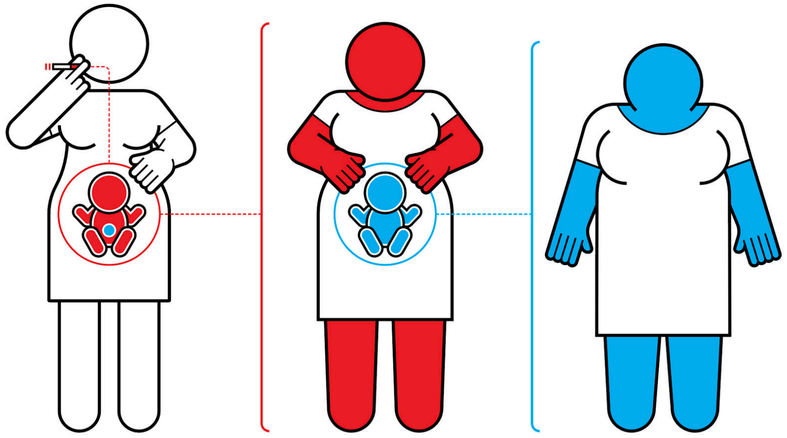
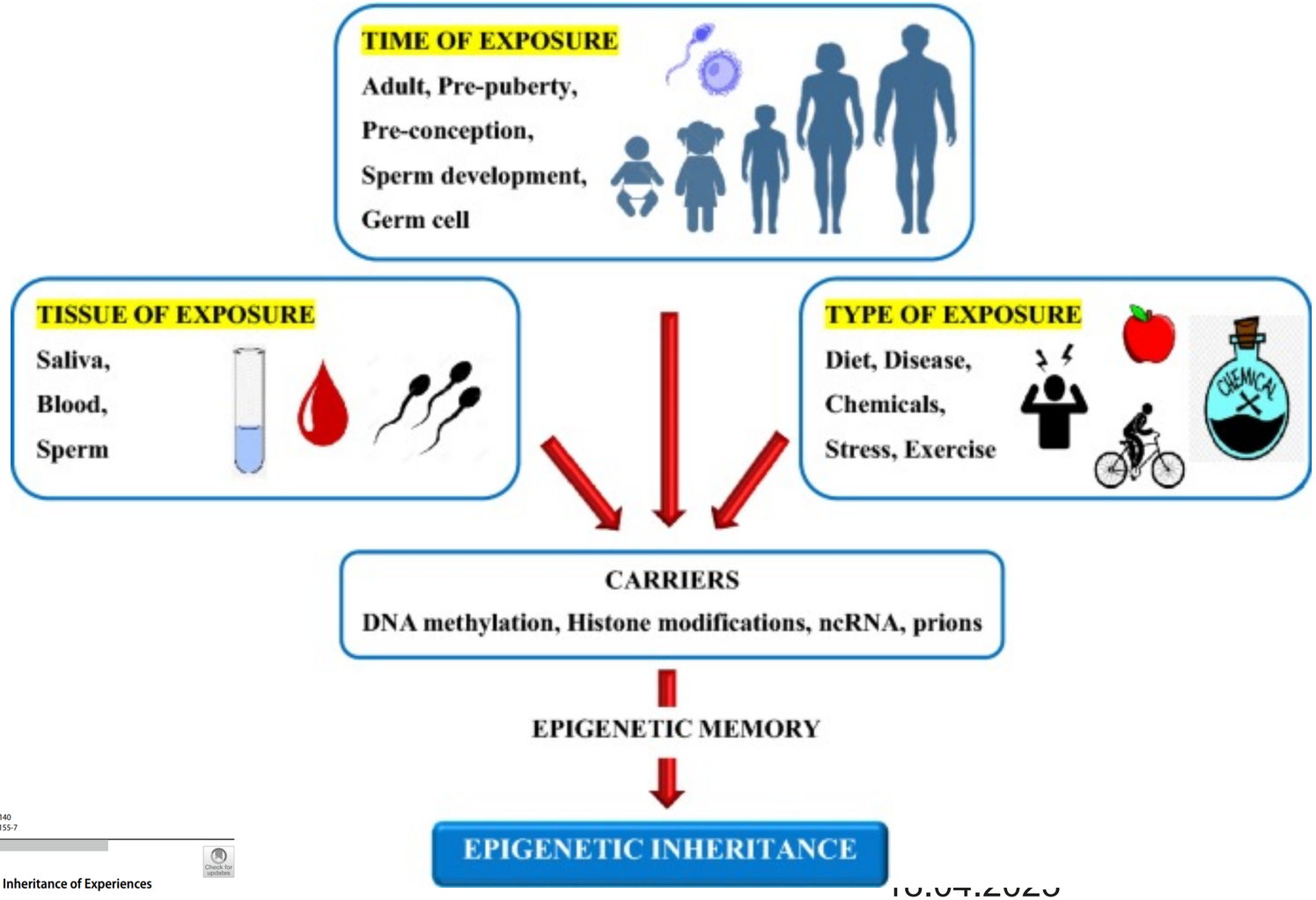
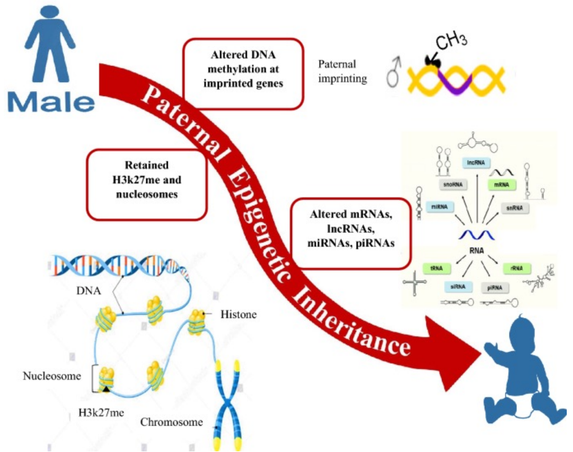
Epigenetic Inheritance



A woman who smokes while pregnant induces epigenetic changes in three generations at once: in herself, her unborn daughter, and her daughter's reproductive cells.





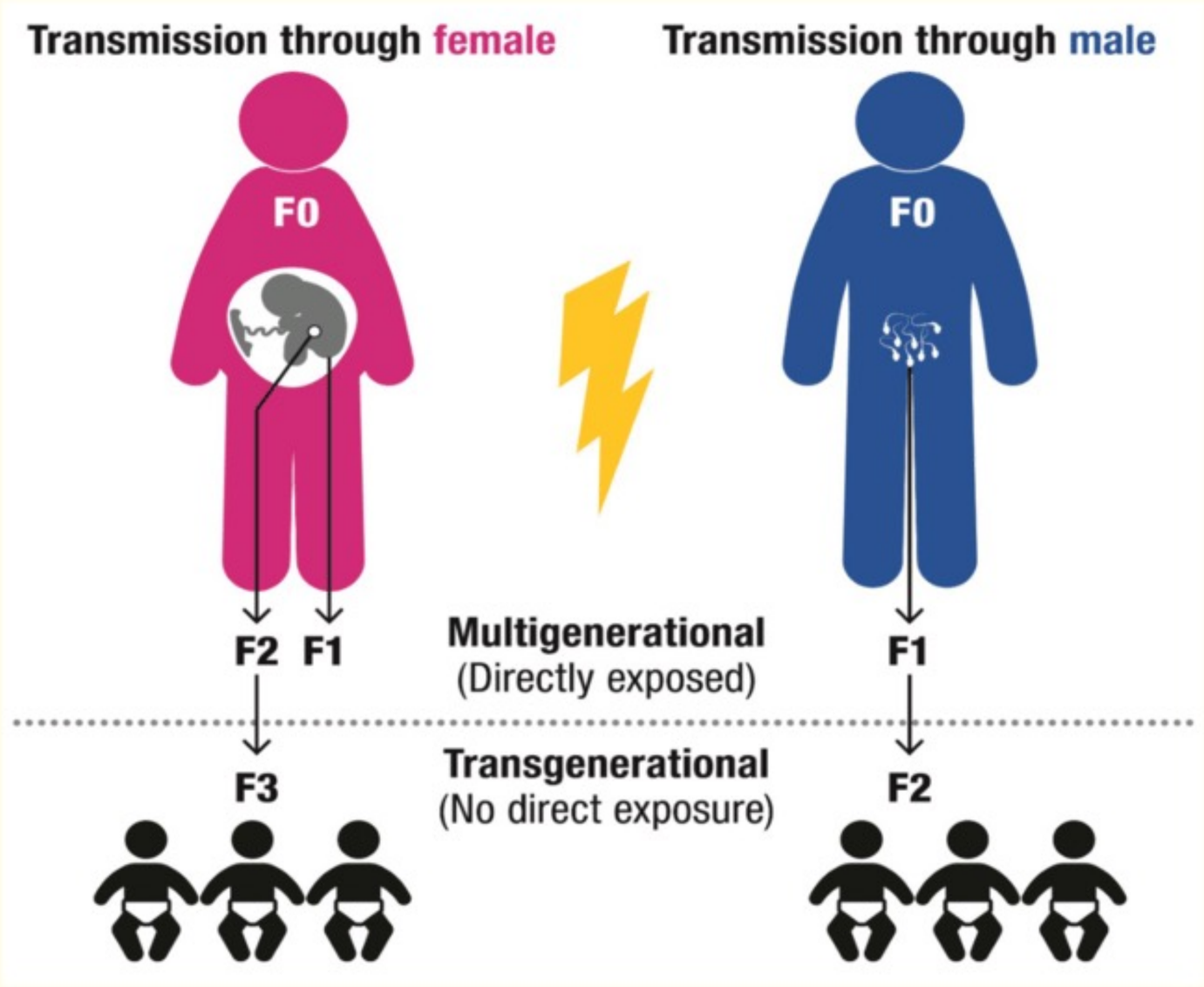
Biochemical Genetics (2022) 60:1107–1140
https://doi.org/10.1007/s10528-021-10155-7

REVIEW

A Review on Epigenetic Inheritance of Experiences in Humans

Meenu Ghai[1] · Farzeen Kader[1]

Potential multi-or trans-generational epigenetic alterations.



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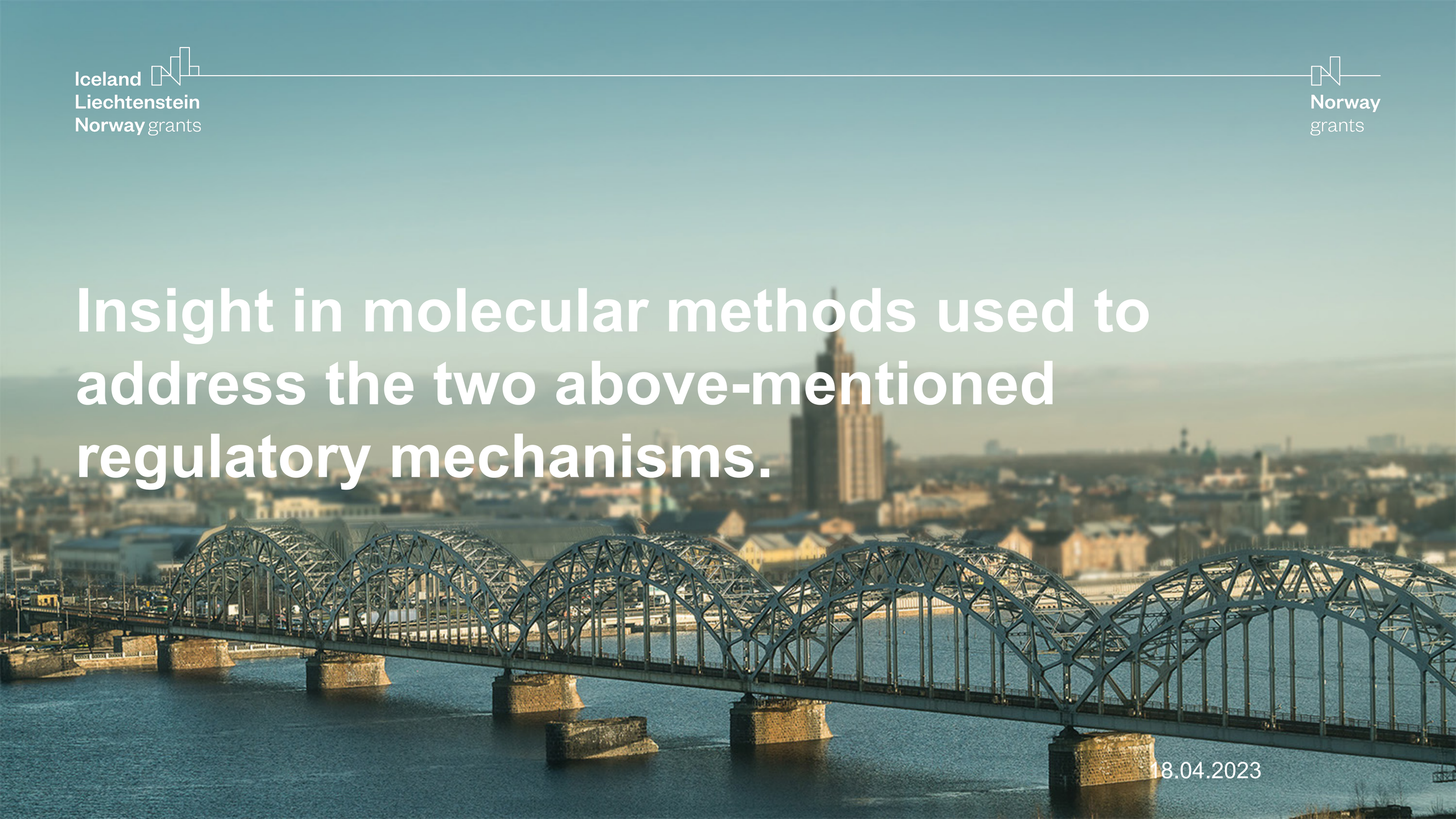
Insight in molecular methods used to address the two above-mentioned regulatory mechanisms.



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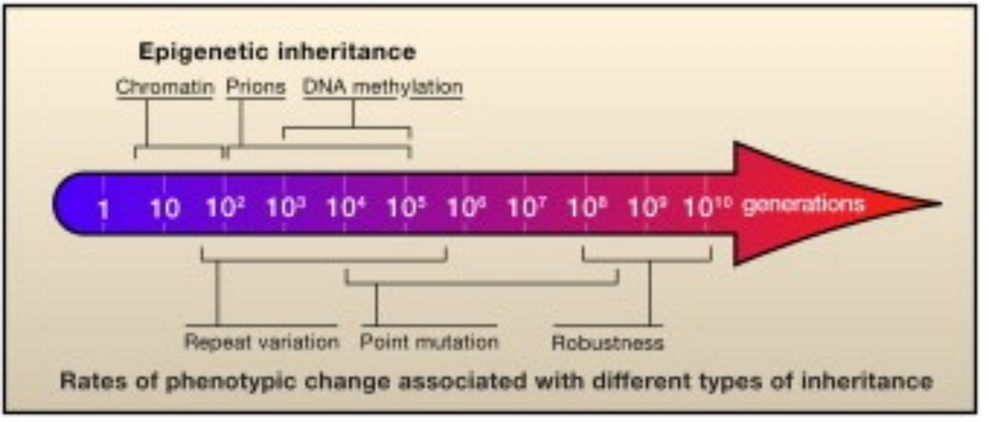
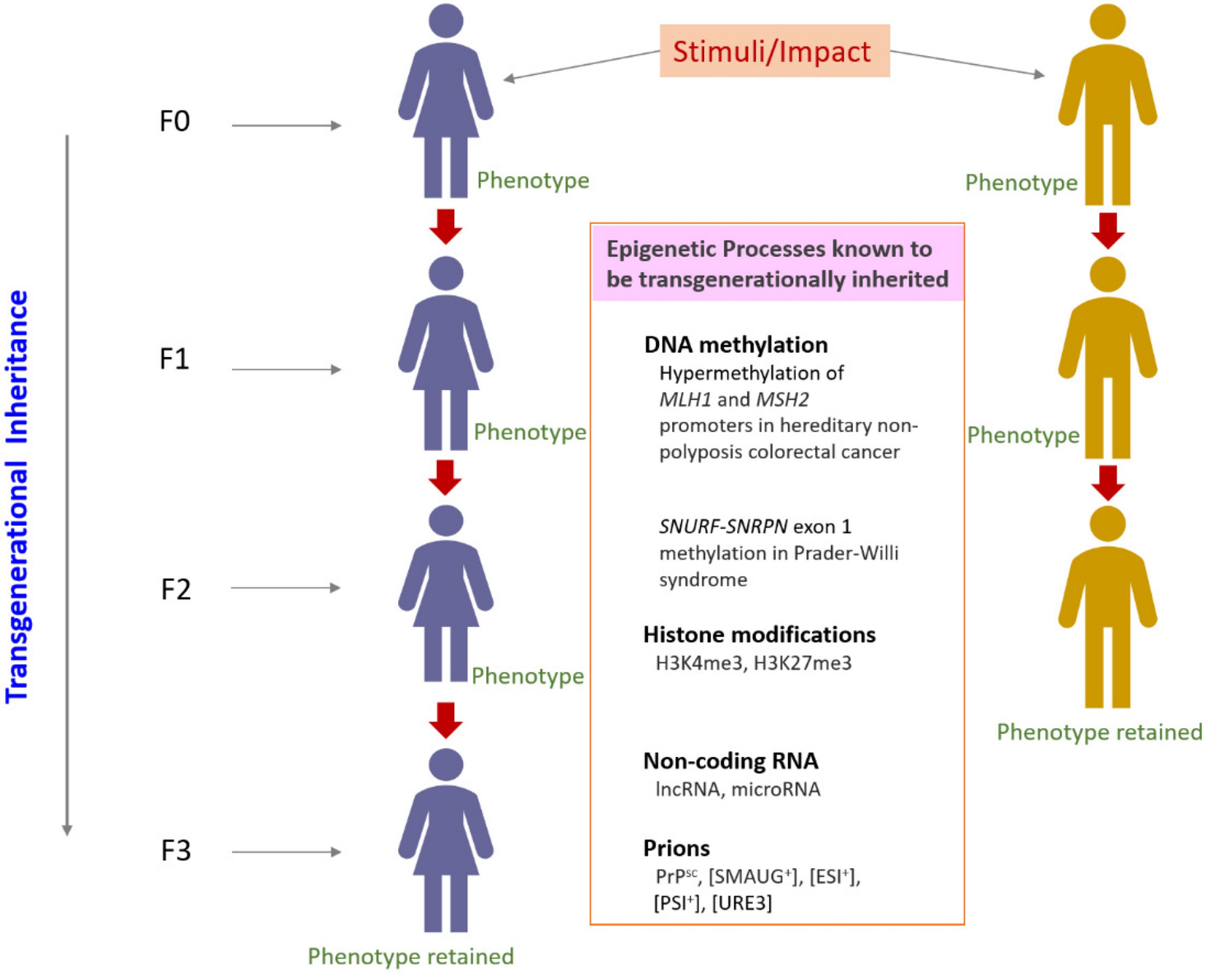
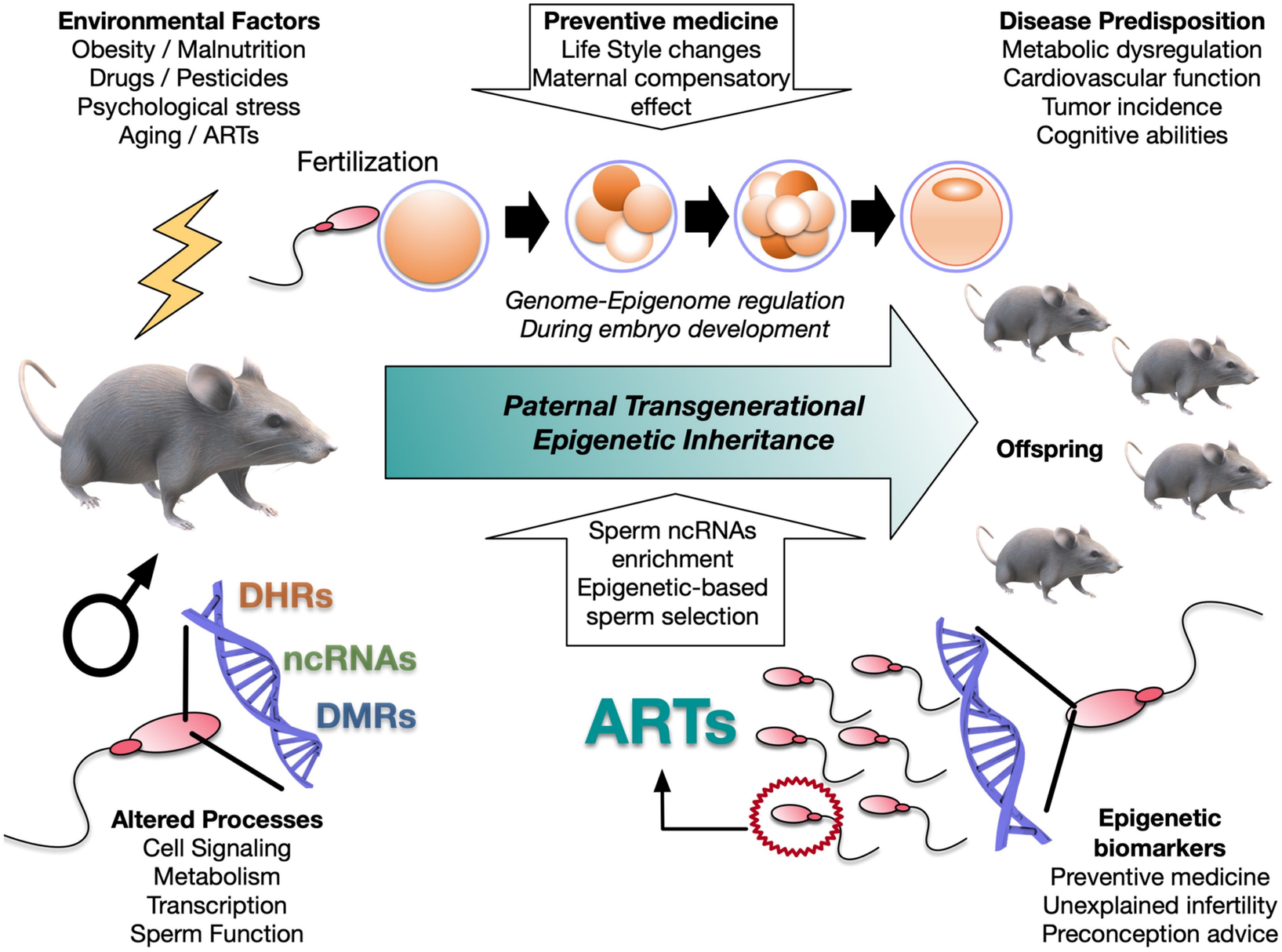


https://doi.org/10.1016/j.cell.2007.01.023



https://doi.org/10.3390/jdb9020020



http://dx.doi.org/10.1186/s40659-021-00364-0

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Epigenetic regulation in disease

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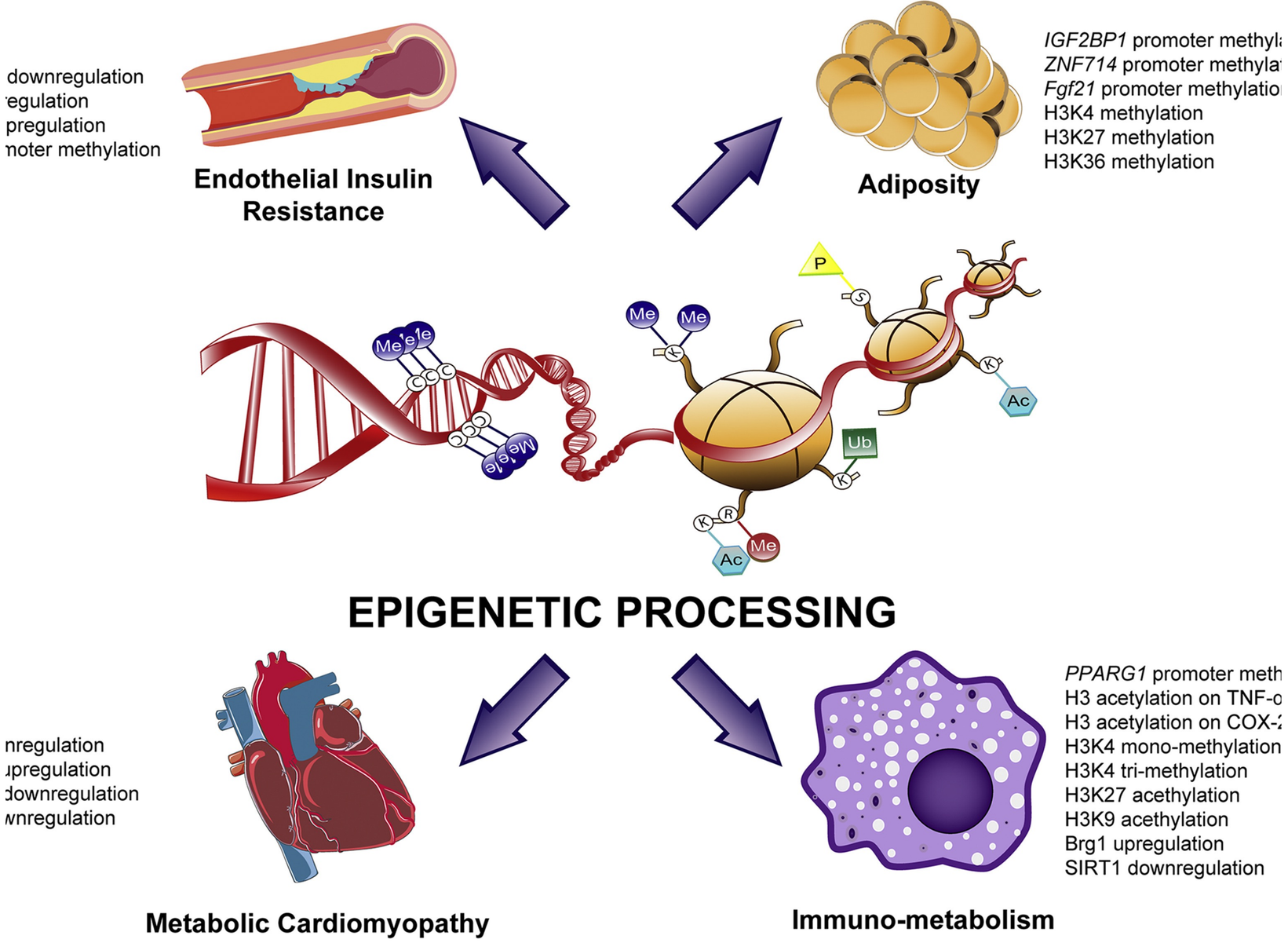

REVIEW ARTICLE | VOLUME 281, P150-158, FEBRUARY 01, 2019
PDF [2 MB]

Epigenetic processing in cardiometabolic disease

Sarah Costantino • Shafeeq A. Mohammed • Samuele Ambrosini • Francesco Paneni

Published: September 26, 2018 • DOI: https://doi.org/10.1016/j.atherosclerosis.2018.09.029 •

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Reversible modifications on protein, DNA, and RNA and their role in cancer.

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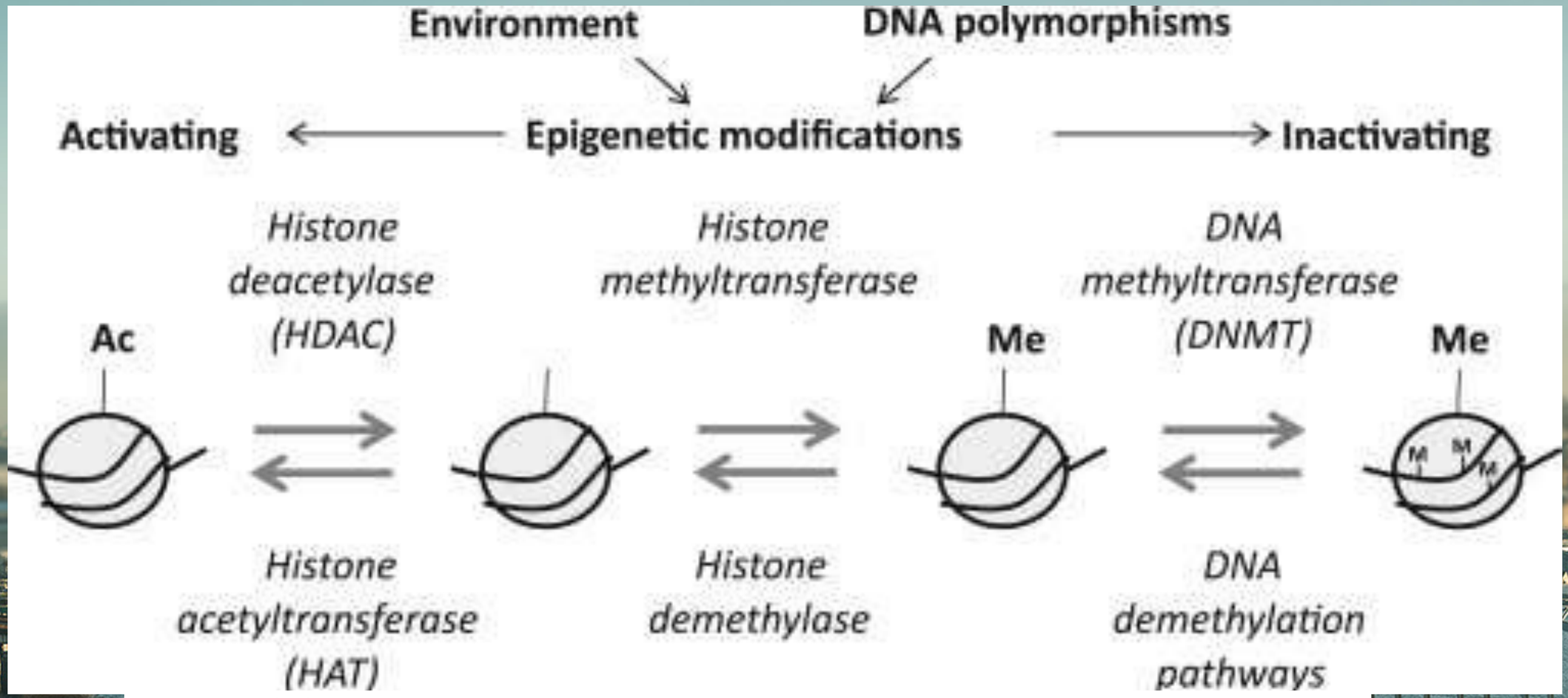

Mitchelmore C, Gede L. Brain Derived Neurotrophic Factor: epigenetic regulation in psychiatric disorders. Brain Res. 2014 Oct 24;1586:162-72. doi: 10.1016/j.brainres.2014.06.037

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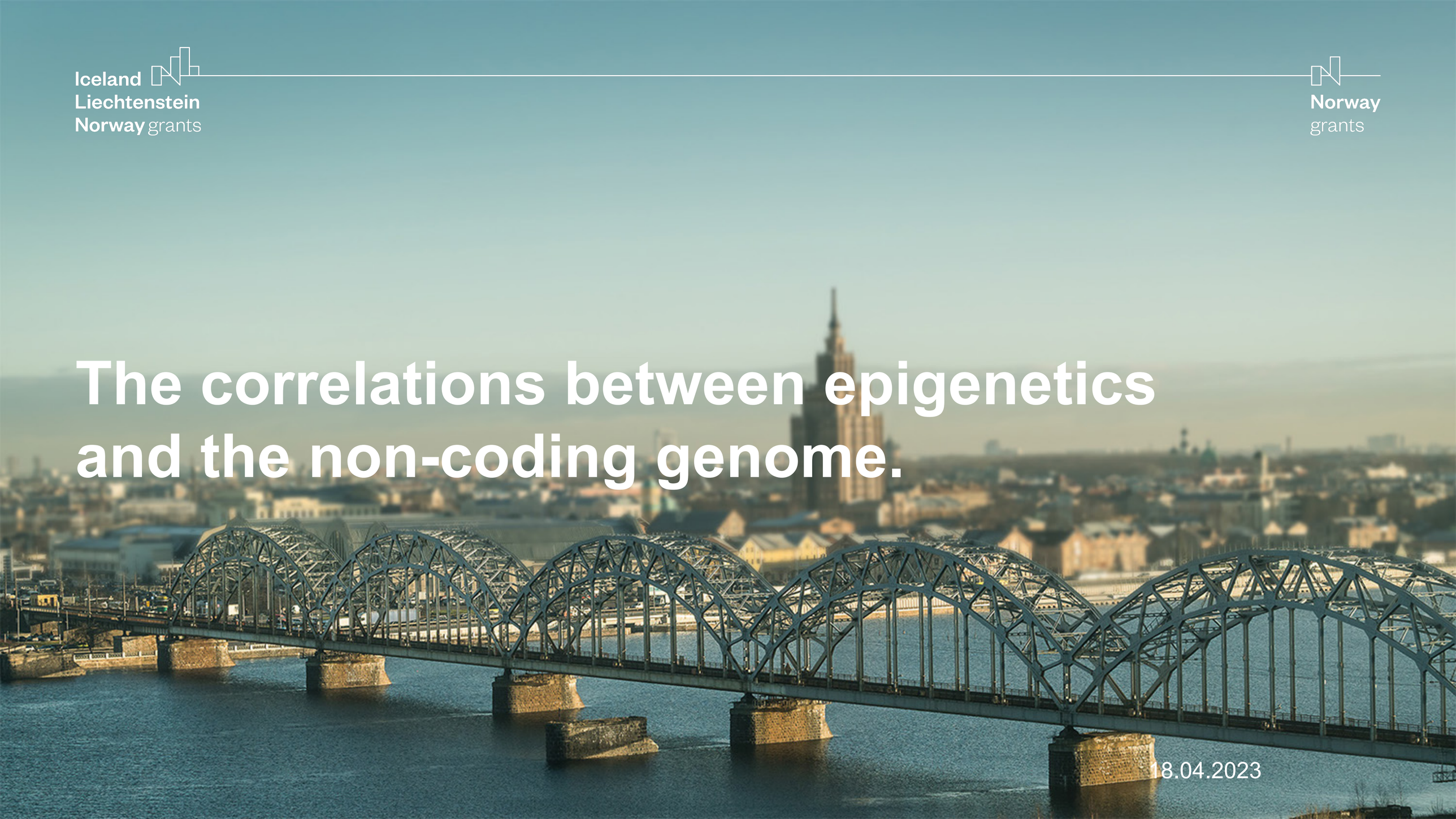

The correlations between epigenetics and the non-coding genome.

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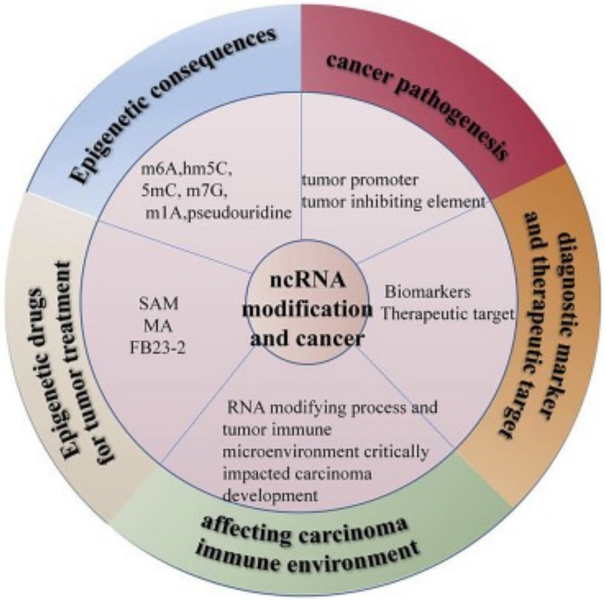
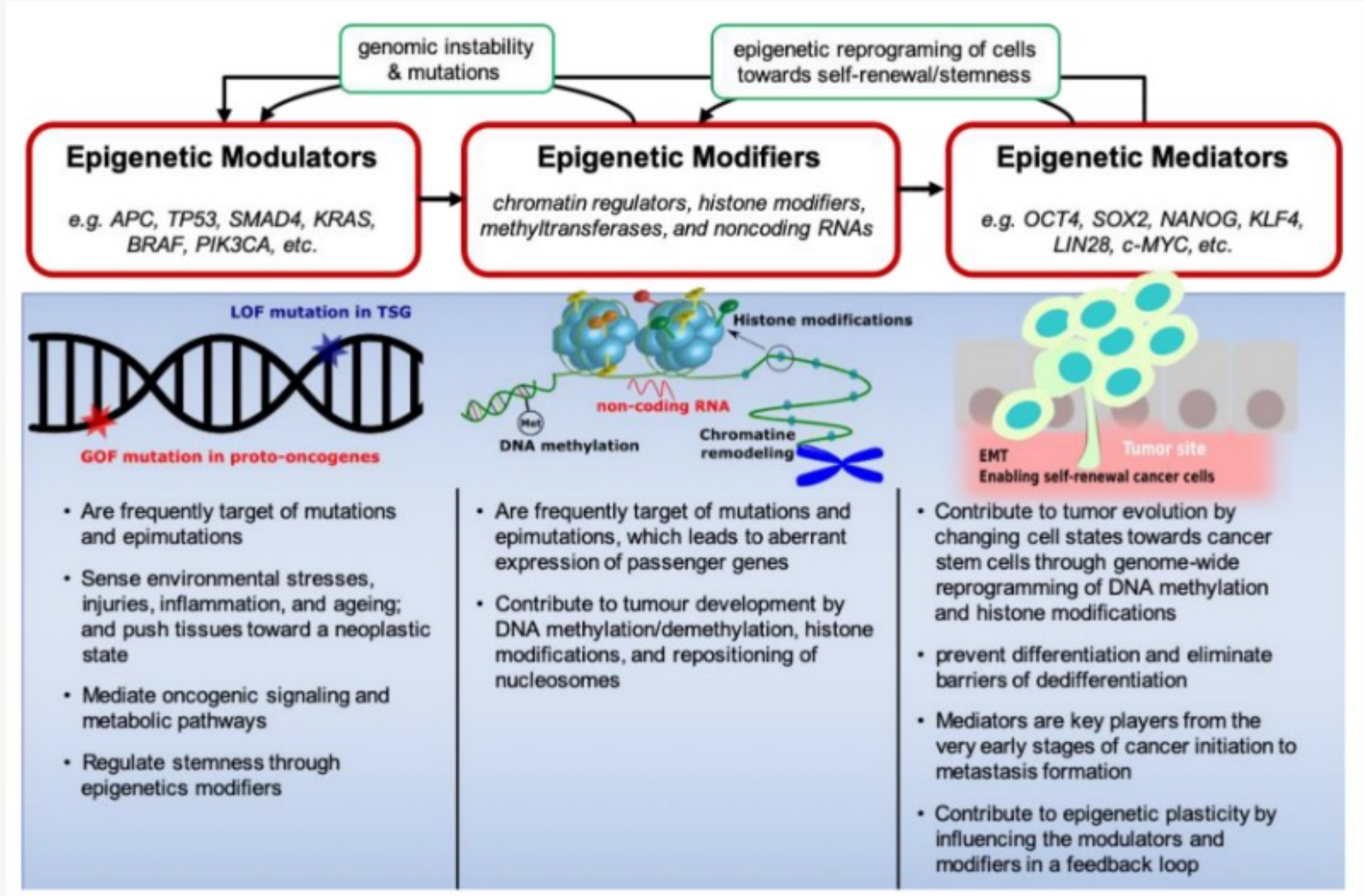
The correlations between epigenetics and the non-coding genome



Rong D, Sun G, Wu F, Cheng Y, Sun G, Jiang W, Li X, Zhong Y, Wu L, Zhang C *et al*: **Epigenetics: Roles and therapeutic implications of non-coding RNA modifications in human cancers**. *Molecular Therapy - Nucleic Acids* 2021, **25**:67-82



Amirkhah R, Naderi-Meshkin H, Shah JS, Dunne PD, Schmitz U: **The Intricate Interplay between Epigenetic Events, Alternative Splicing and Noncoding RNA Deregulation in Colorectal Cancer**. *Cells* 2019, **8**(8):929

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Diagnostic and therapeutic approaches using epigenetics.

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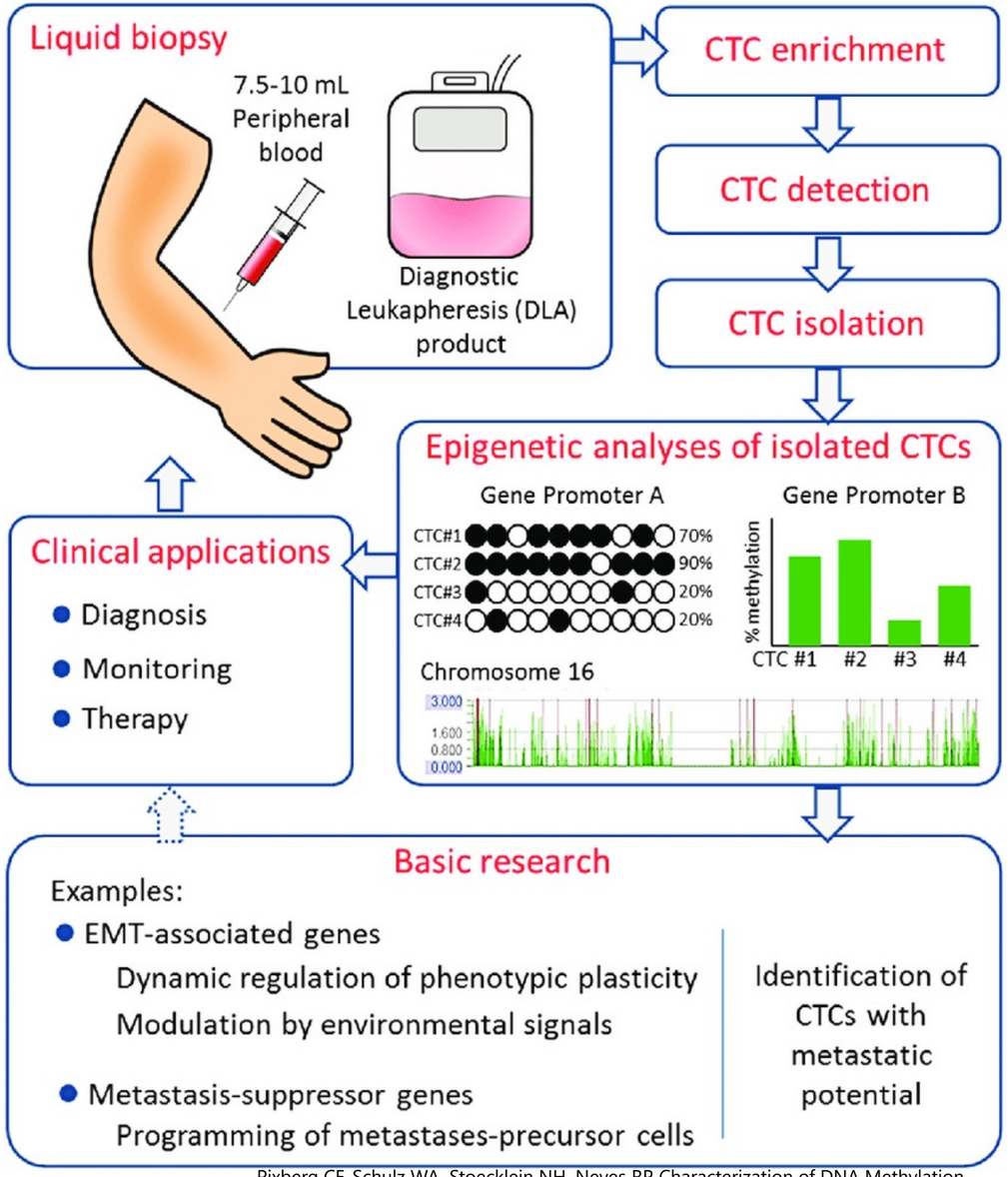
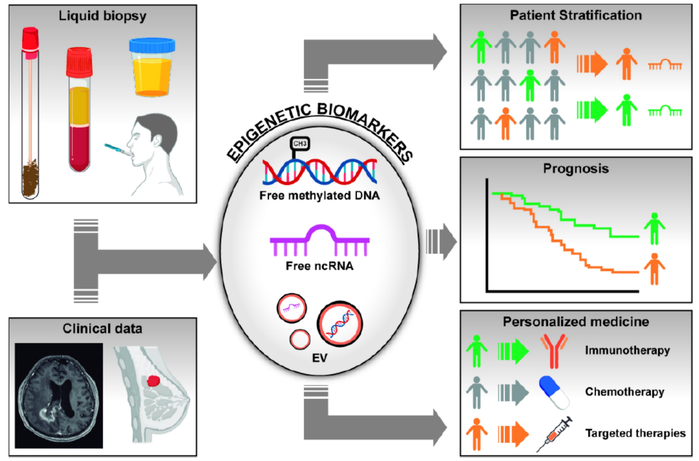
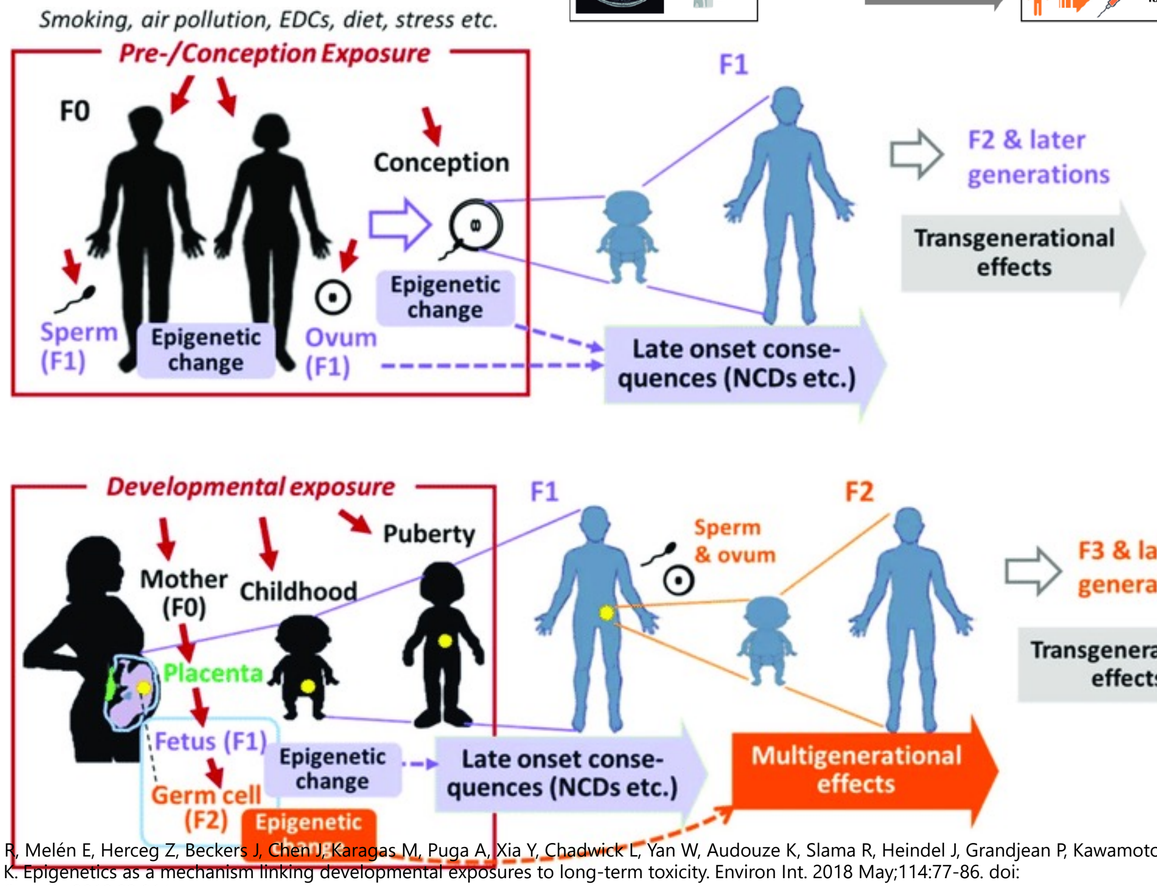
Diagnostic approaches using epigenetics



Pixberg CF, Schulz WA, Stoecklein NH, Neves RP. Characterization of DNA Methylation in Circulating Tumor Cells. Genes (Basel). 2015 Oct 21;6(4):1053-75





Barouki R, Melén E, Herceg Z, Beckers J, Chen J, Karagas M, Puga A, Xia Y, Chadwick L, Yan W, Audouze K, Slama R, Heindel J, Grandjean P, Kawamoto T, Nohara K. Epigenetics as a mechanism linking developmental exposures to long-term toxicity. Environ Int. 2018 May;114:77-86. doi: 10.1016/j.envint.2018.02.014.

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New available methods in the study of epigenetic alterations.

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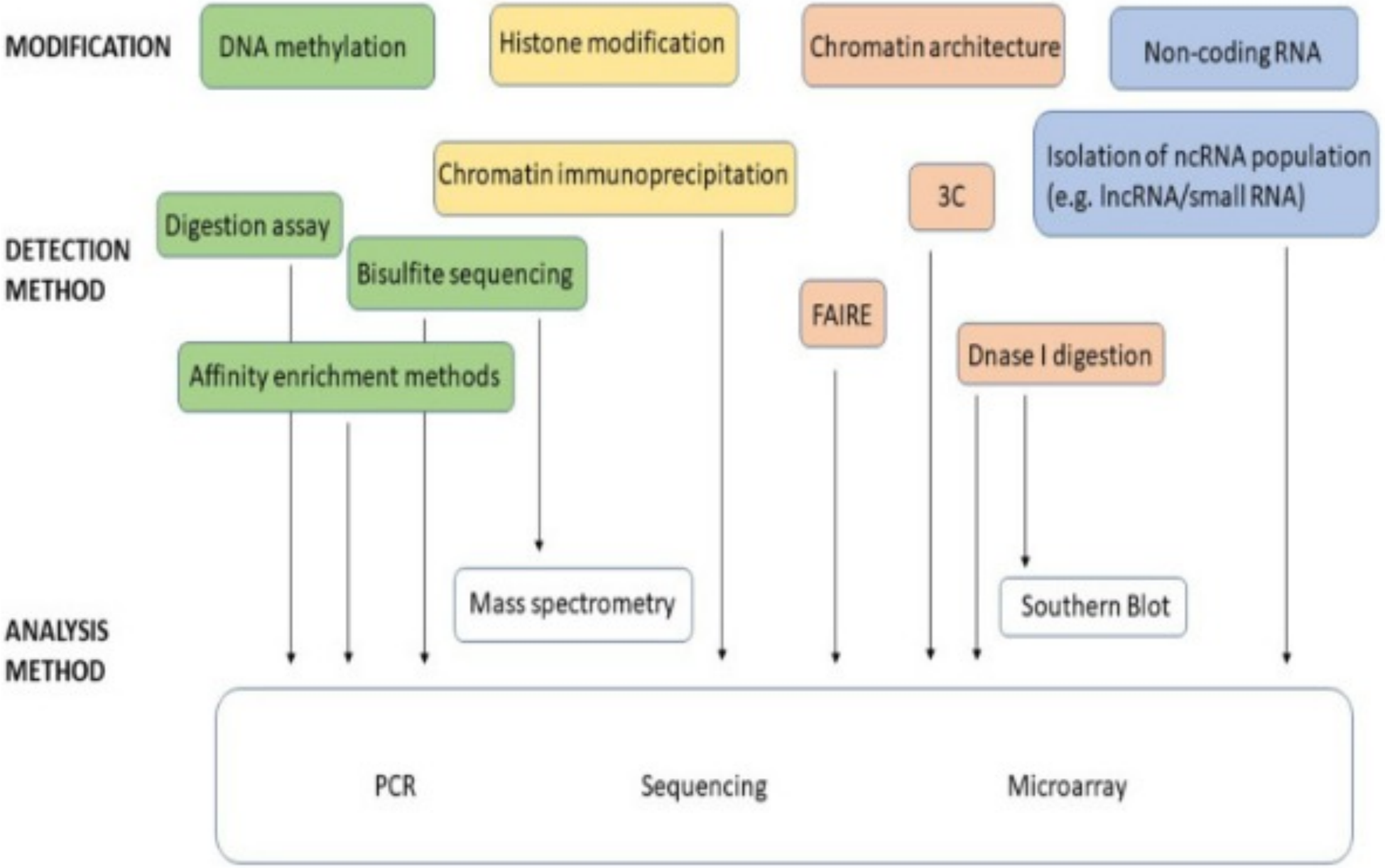
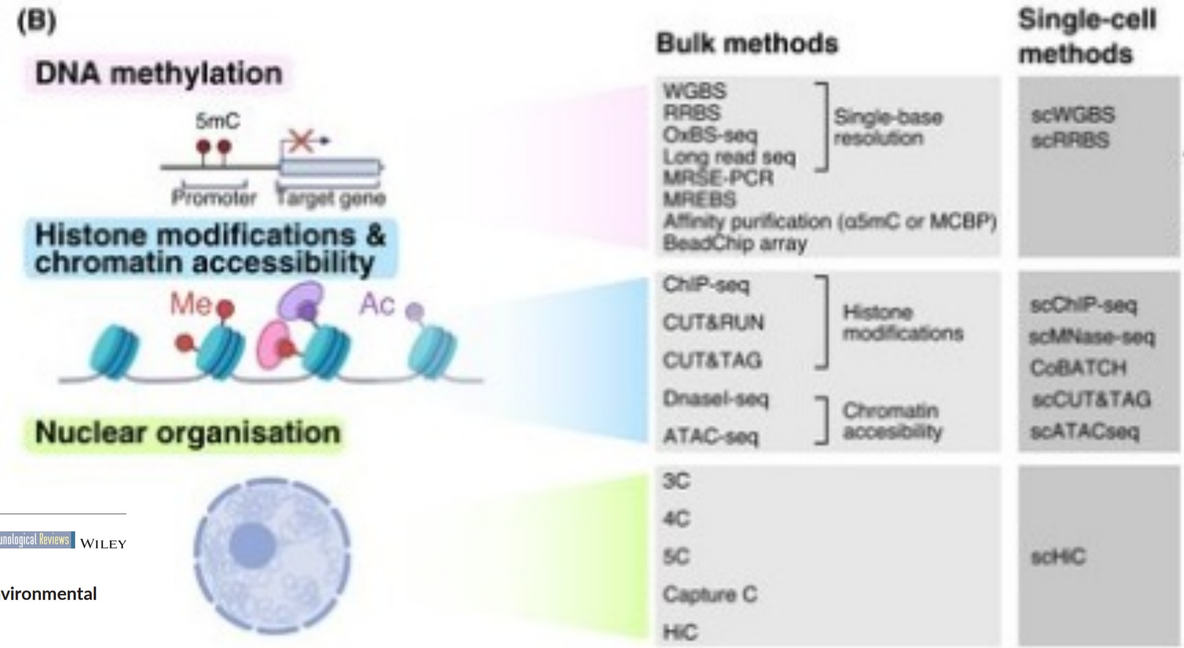
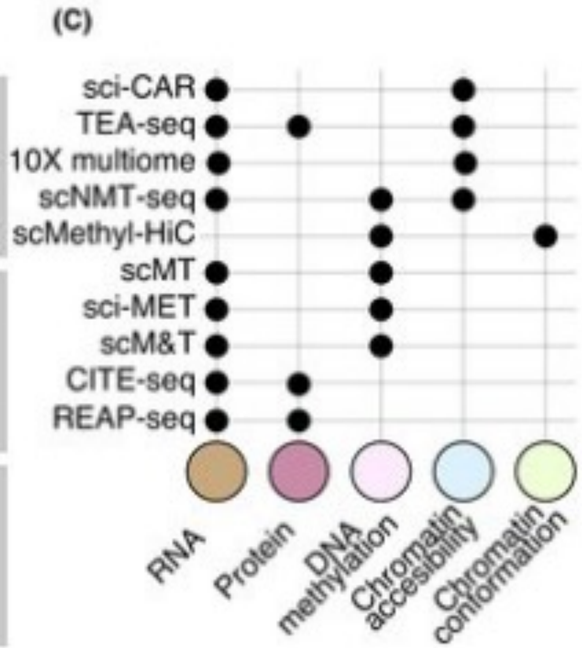

MODIFICATION
DNA methylation
Histone modification
Chromatin architecture
Non-coding RNA
DETECTION METHOD
Digestion assay
Chromatin immunoprecipitation
3C
Isolation of ncRNA population (e.g. lncRNA/small RNA)
Bisulfite sequencing
FAIRE
Affinity enrichment methods
Dnase I digestion
Mass spectrometry
Southern Blot
ANALYSIS METHOD
PCR
Sequencing
Microarray

Methods to study epigenetics at bulk and single-cell resolution





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DOI: 10.1111/imr.13036
INVITED REVIEW
INVITED REVIEW THEMED ISSUE
Immunological Reviews WILEY

Epigenetics and tissue immunity—Translating environmental cues into functional adaptations*

Zewen Kelvin Tuong[1,2] | Benjamin J. Stewart[1,2] | Shuang Andrew Guo[1,2] | Menna R. Clatworthy[1,2,3]

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Thank you!