Part 3:

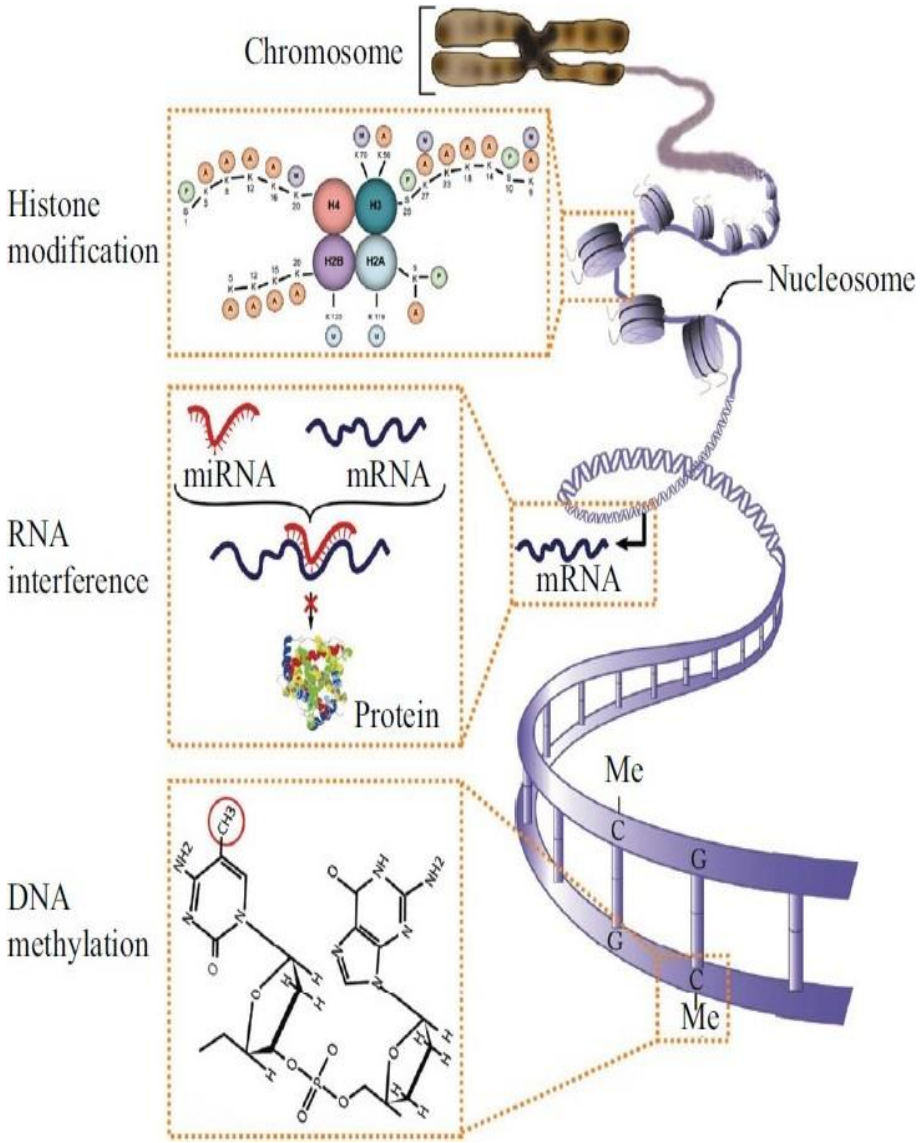
- Genetics epigenetics, food and reproduction


EPIGENETICS
CAPACITANCE
INHERITANCE
VALPROIC
MODIFICATION
ABNORMALITIES
LOCATIONS
OBSERVED
MONOZYGOTIC
EUKARYOTIC
DIFFERENTIATION
MULTIGENERATIONAL
CHANGE
STATE
UNICELLULAR
TERATOGENS
CODE
EMBRYOPROTEIN
MAMMALS
REPLICATION
GENERATION
GENOME
METHYLATION
DOMAIN
LOCALIZES
ZYGOTE
TRANSCRIPTION
FEATURES

DNA IS NOT DESTINY

The new science of epigenetics rewrites the rules of disease, heredity, and identity

By Ethan Watters


Chromosome
Histone modification
H4
H3
H2B
H2A
Nucleosome
RNA interference
miRNA
mRNA
Protein
mRNA
DNA methylation
CH3
NH2
NH
Me
C
G
G
C
Me

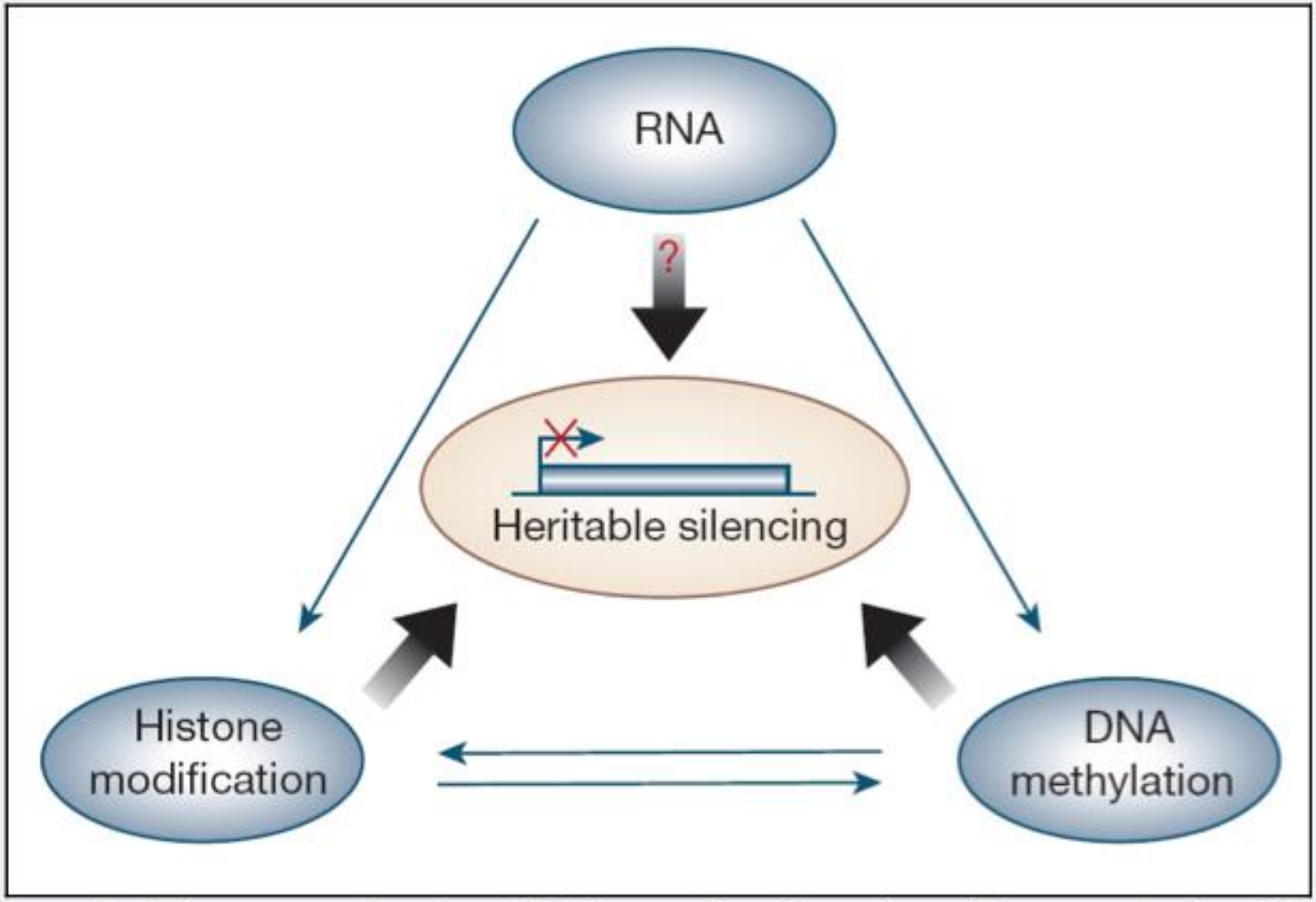
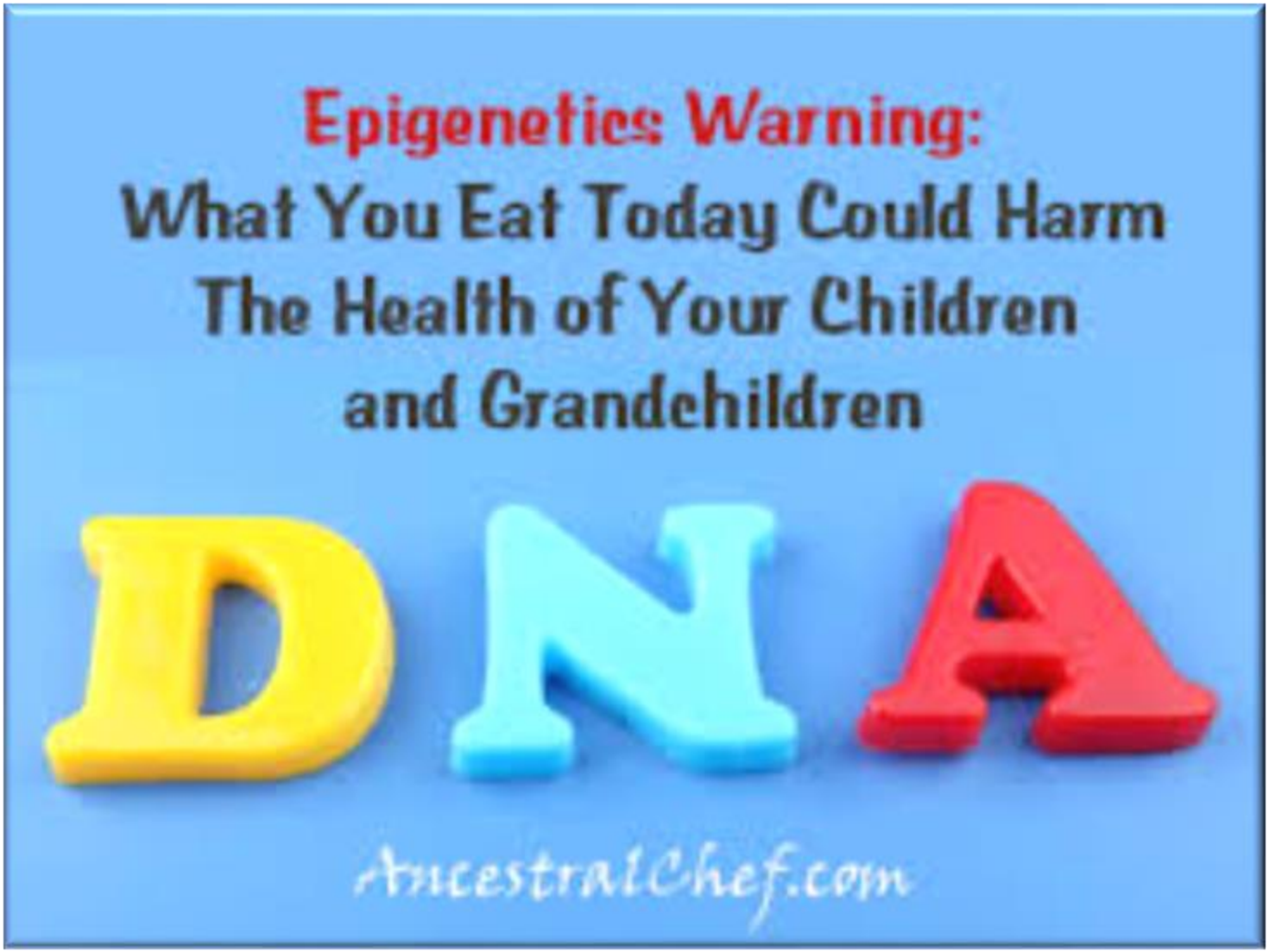
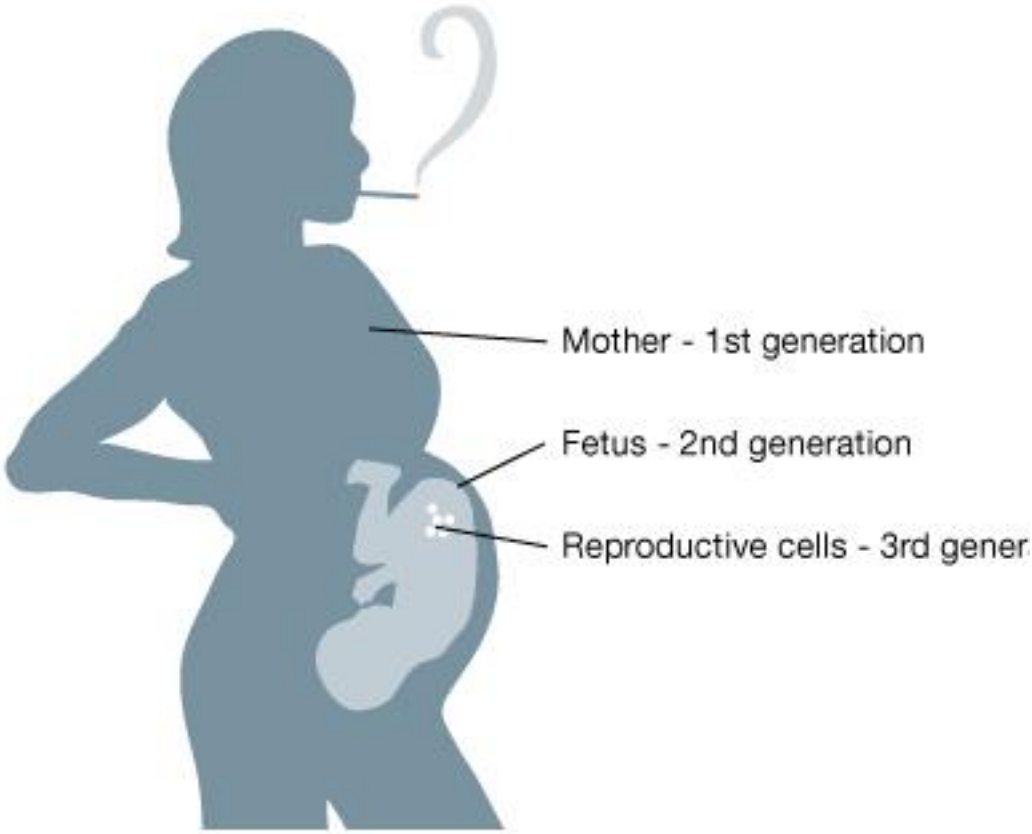


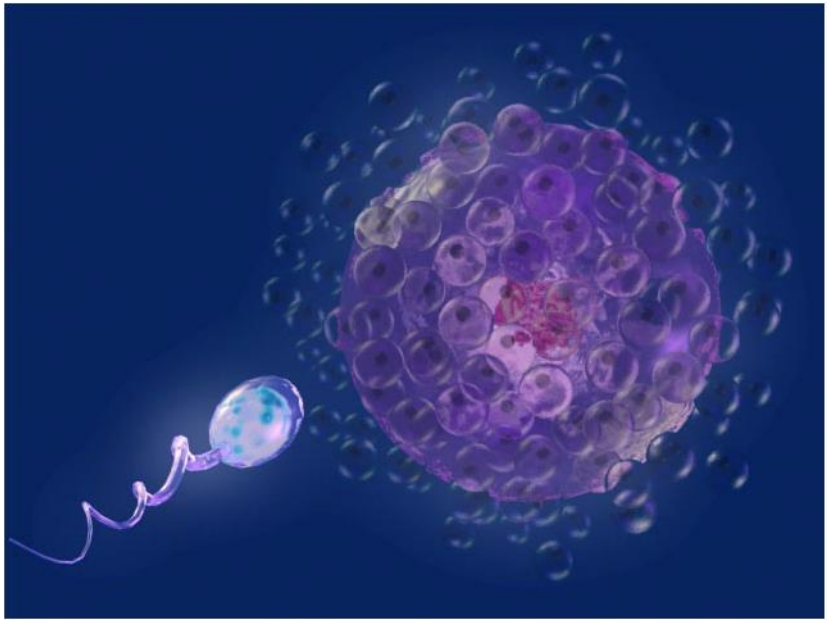
Figure 2. Three methods of Epigenetic silencing (Egger et al., 2004)

A phenomenon of methylation in plants.

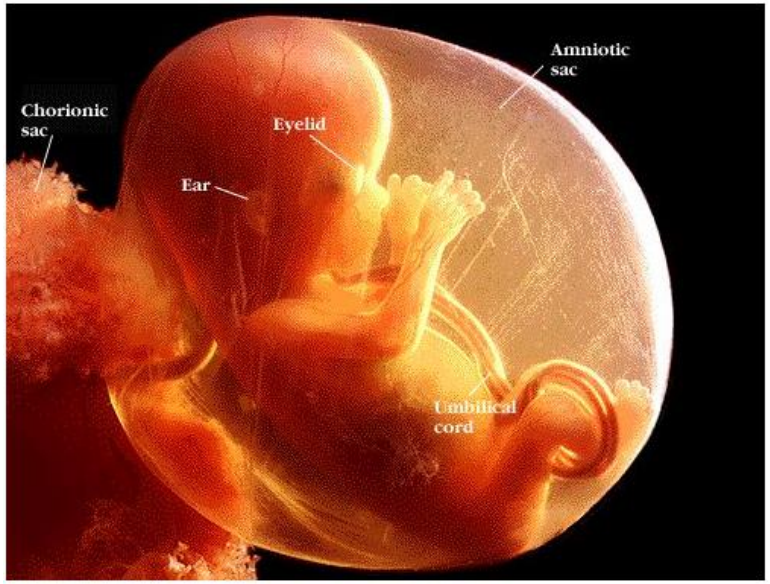

Epigenetics Warning:
What You Eat Today Could Harm
The Health of Your Children
and Grandchildren
DNA
AncestralChef.com


Mother - 1st generation
Fetus - 2nd generation
Reproductive cells - 3rd gener

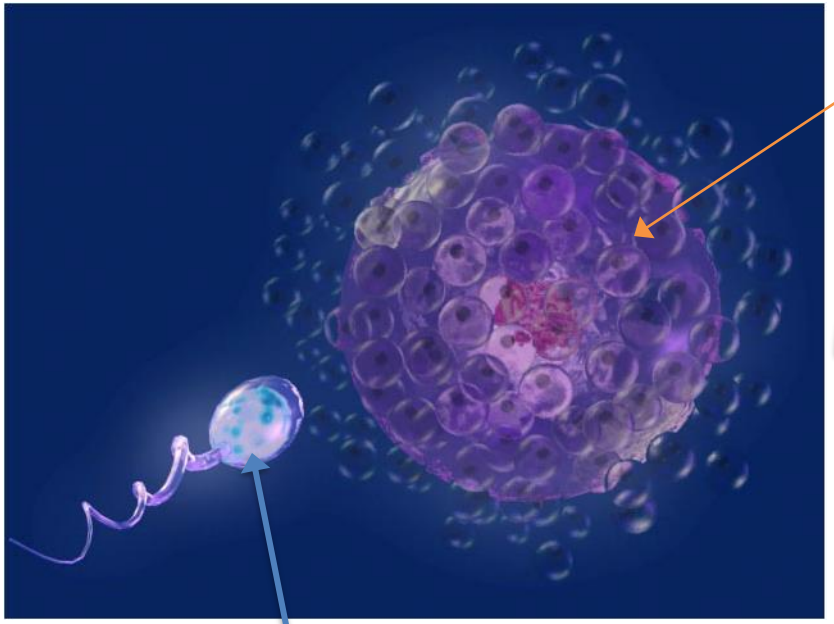
Sexual reproduction: the genetic vision



23+23=46



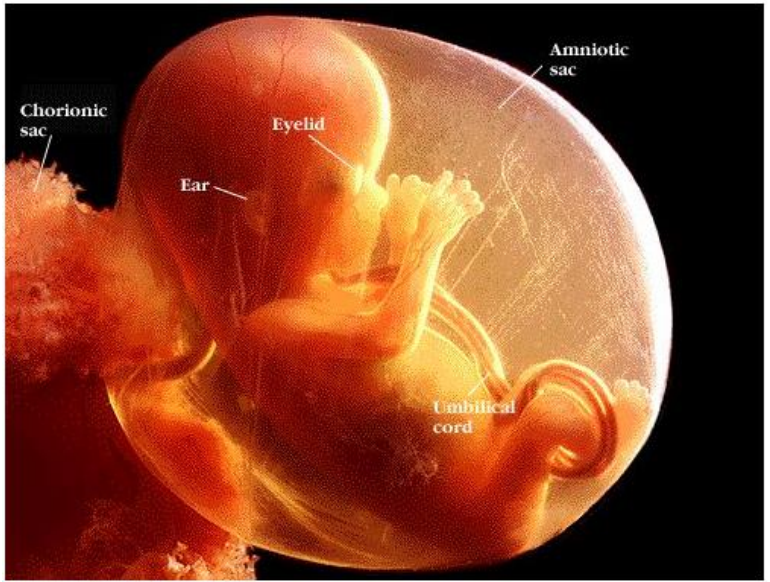
Sexual reproduction: the epigenetic vision



Paternal life style

Paternal life style

Different susceptibility to late onset diseases



Review

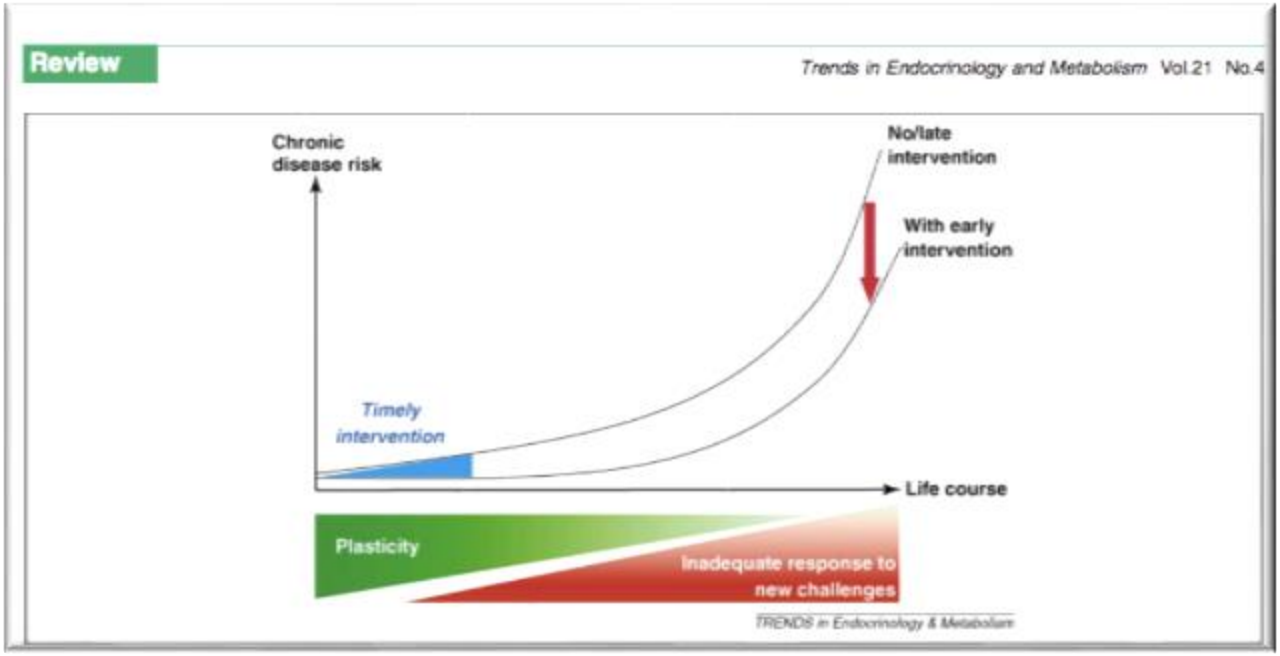
Cell

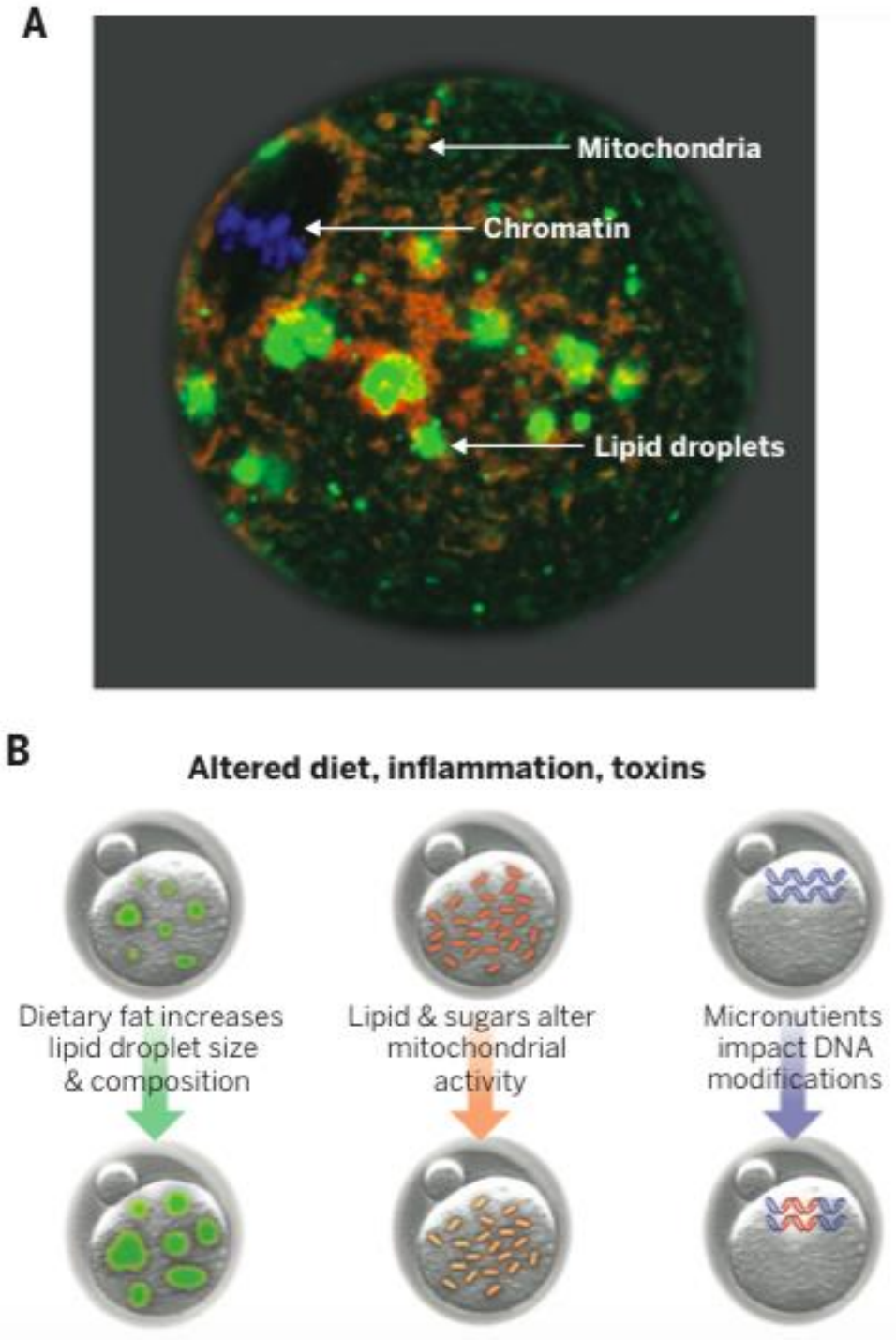
Developmental origins of metabolic disease: life course and intergenerational perspectives

Keith M. Godfrey[1,2,3], Peter D. Gluckman[4,5] and Mark A. Hanson[1,2]

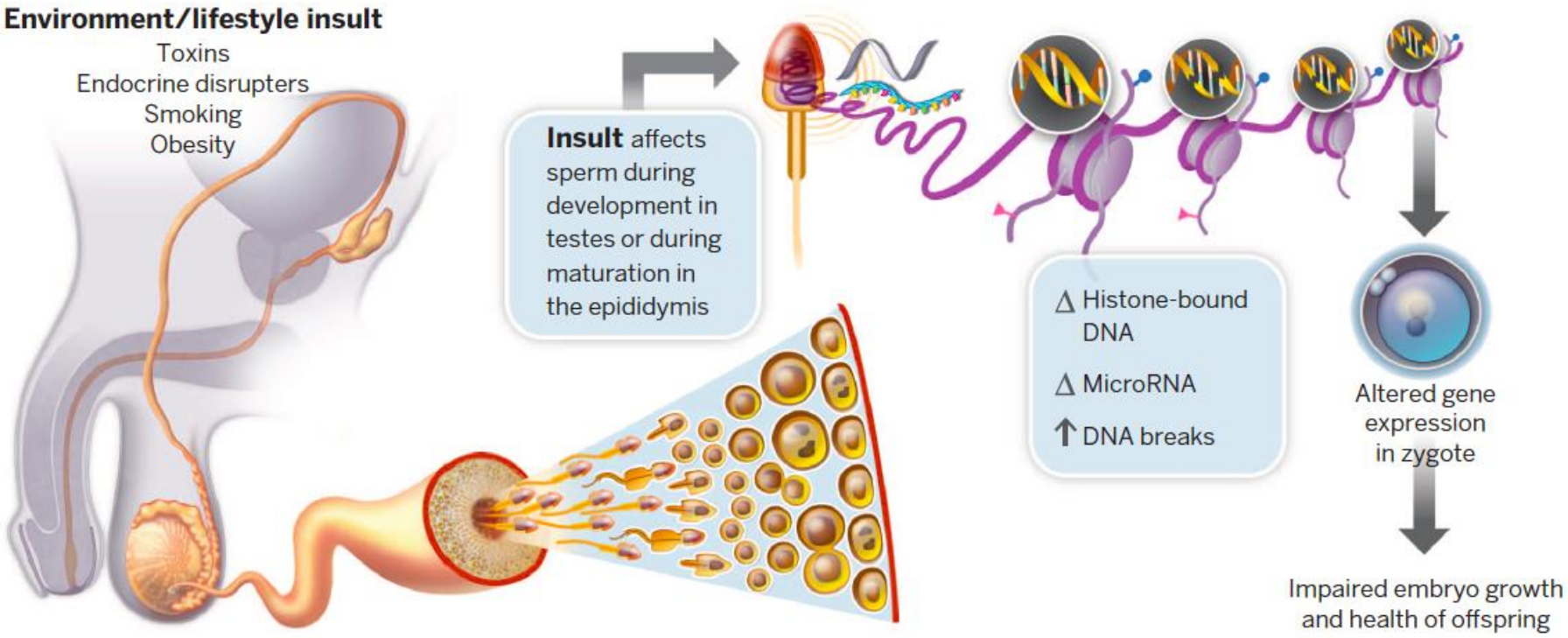
[1] University of Southampton School of Medicine, Southampton, UK
[2] NIHR Biomedical Research Unit in Nutrition, Diet & Lifestyle
[3] MRC Epidemiology Resource Centre, Southampton, UK
[4] Liggins Institute, University of Auckland, NZ
[5] Singapore Institute for Clinical Sciences, Singapore

Although the greatest increase occurs in adult life, the trajectory is set much earlier, being influenced by factors such as the <u>mother's diet and body composition before and during pregnancy</u>, and fetal, infant and childhood nutrition and development



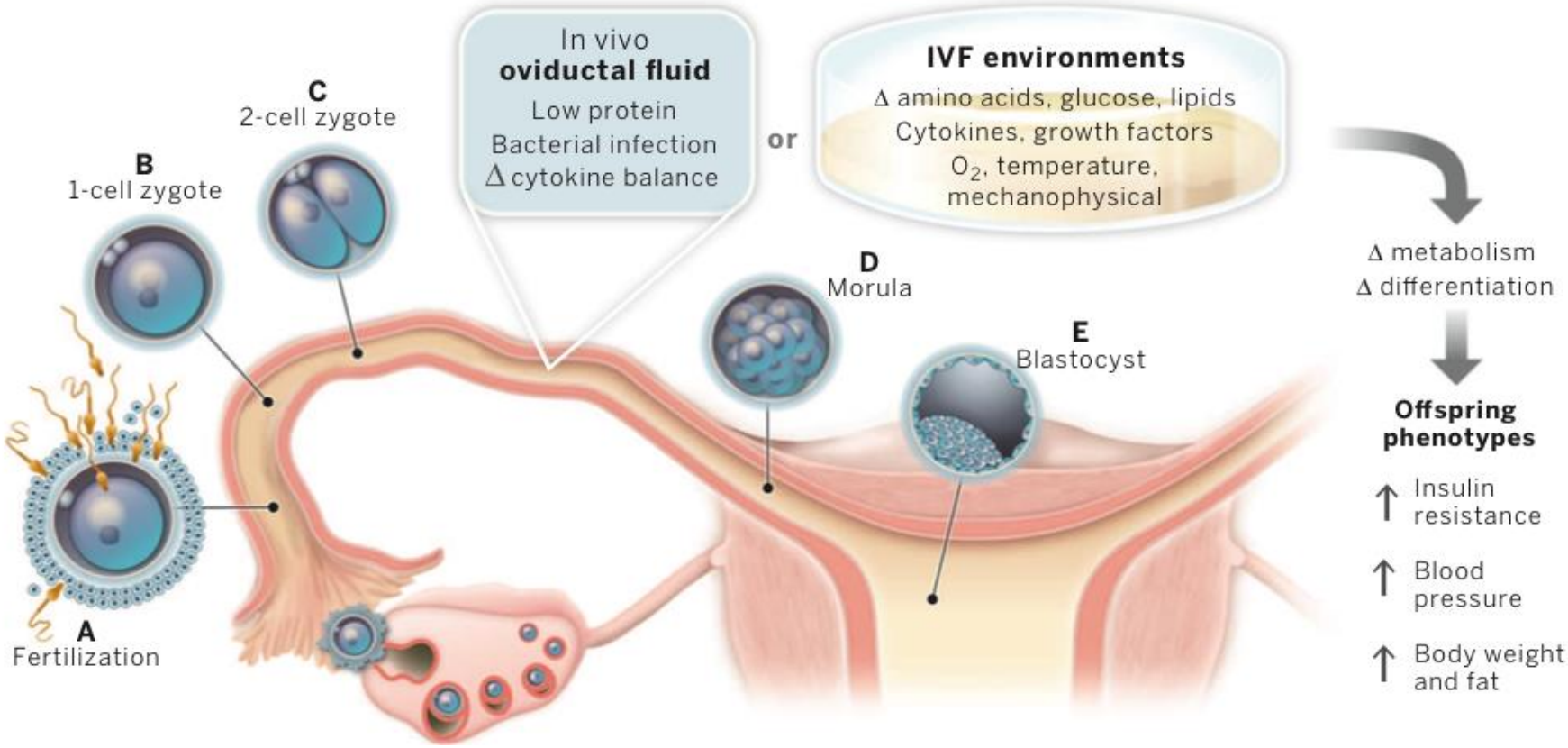


Lane et al., Science 2014


Environment/lifestyle insult
Toxins
Endocrine disrupters
Smoking
Obesity
Insult affects sperm during development in testes or during maturation in the epididymis
Δ Histone-bound DNA
Δ MicroRNA
↑ DNA breaks
Altered gene expression in zygote
Impaired embryo growth and health of offspring

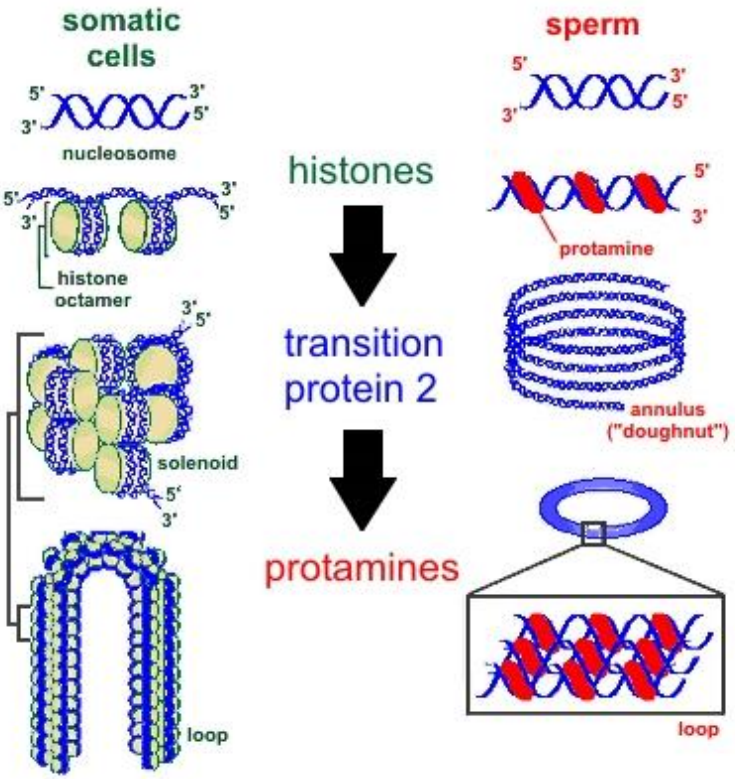
Parenting from before conception

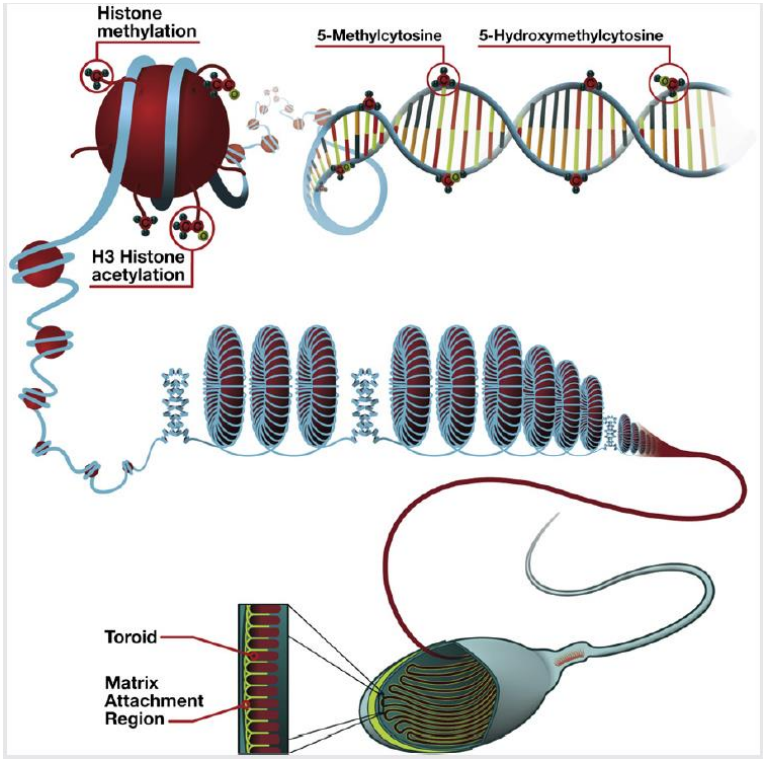
Michelle Lane, Rebecca L. Robker, Sarah A. Robertson*



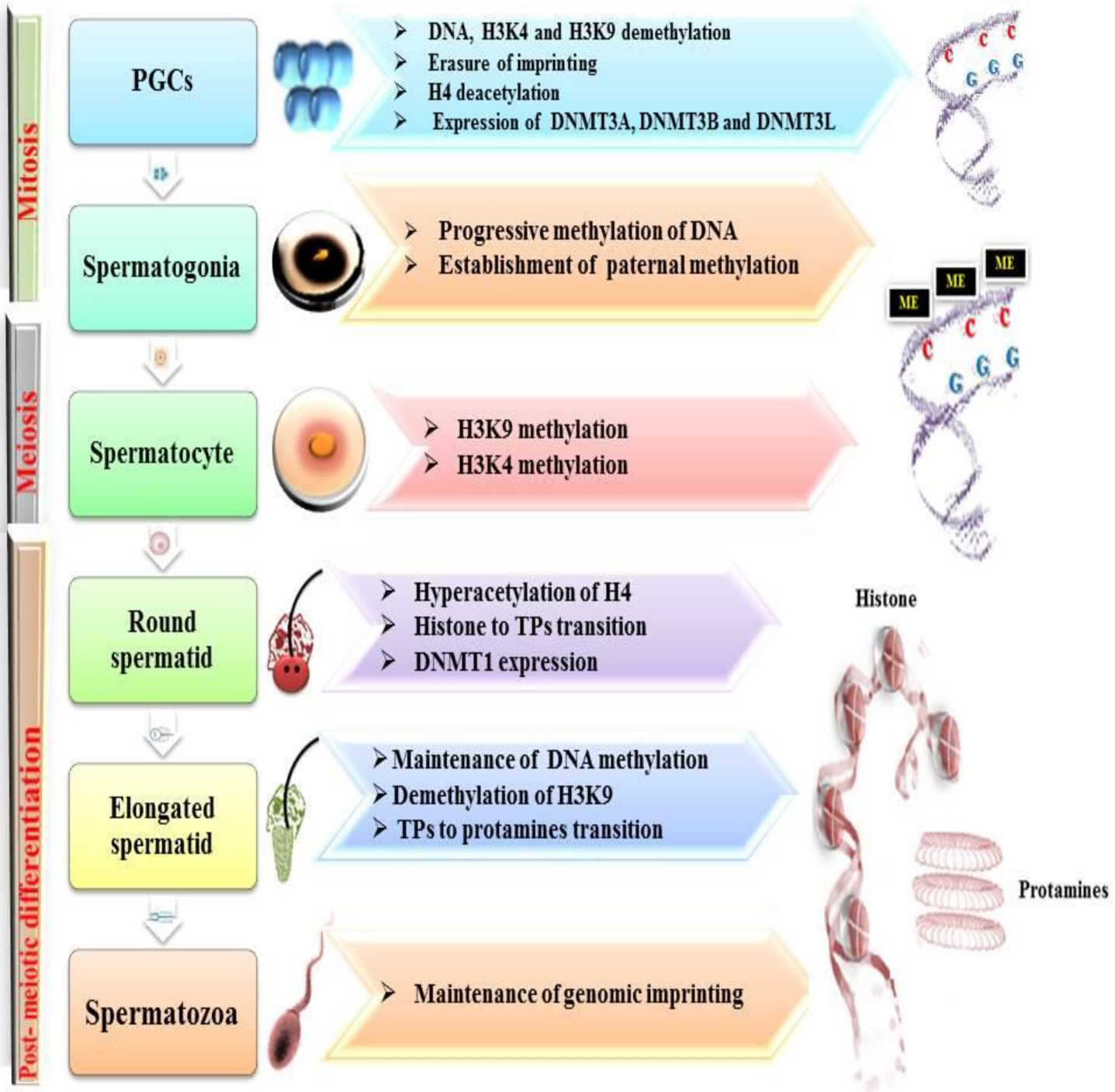
Epigenetics of the male gamete

Douglas T. Carrell, Ph.D., H.C.L.D.
Departments of Surgery (Urology), Obstetrics and Gynecology, and Physiology, University of Utah School of Medicine, Salt Lake City, Utah





Tough nut to crack…

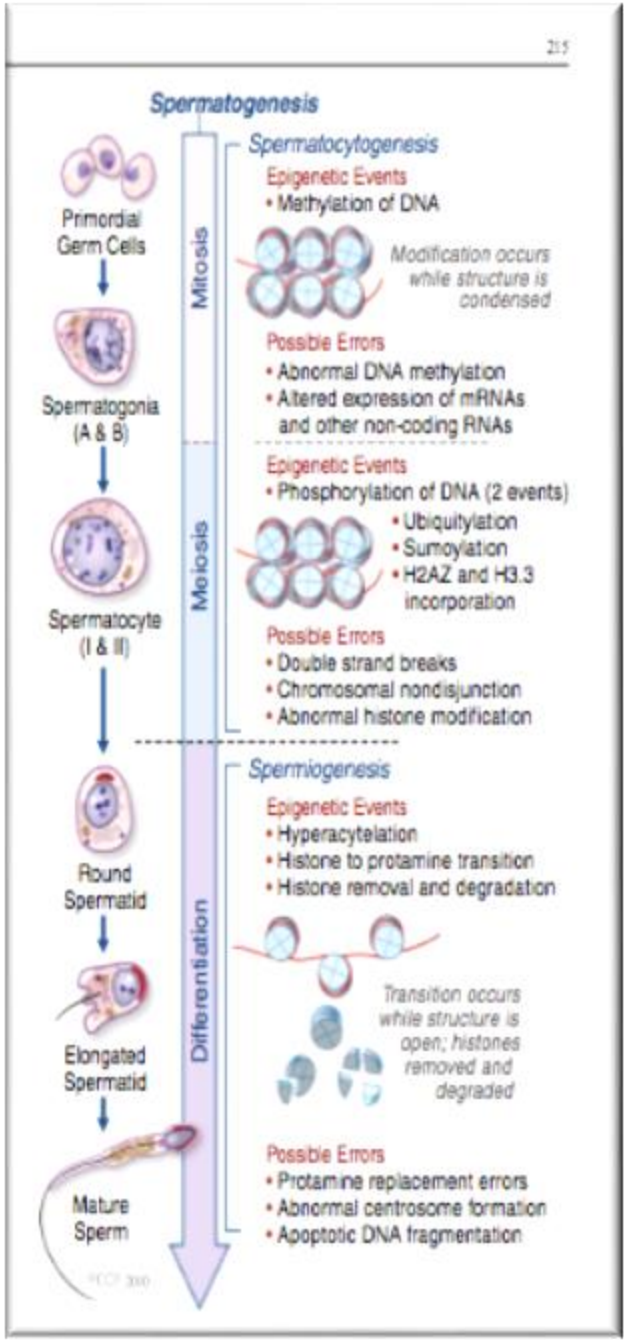

Mitosis
Meiosis
Post-meiotic differentiation
PGCs
DNA, H3K4 and H3K9 demethylation
Erasure of imprinting
H4 deacetylation
Expression of DNMT3A, DNMT3B and DNMT3L
Spermatogonia
Progressive methylation of DNA
Establishment of paternal methylation
ME
Spermatocyte
H3K9 methylation
H3K4 methylation
Round spermatid
Hyperacetylation of H4
Histone to TPs transition
DNMT1 expression
Histone
Elongated spermatid
Maintenance of DNA methylation
Demethylation of H3K9
TPs to protamines transition
Protamines
Spermatozoa
Maintenance of genomic imprinting

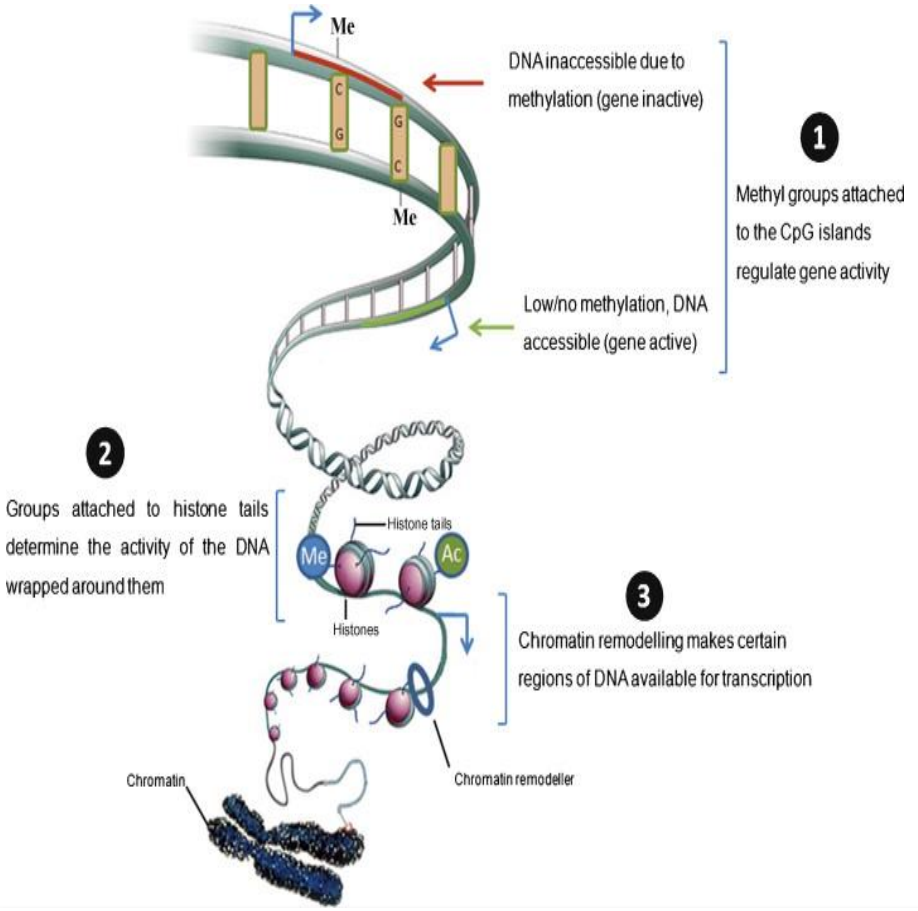
J Assist Reprod Genet (2012) 29:213–223
DOI 10.1007/s10815-012-9715-0

REVIEW

Epigenetics and its role in male infertility

Rima Dada · Manoj Kumar · Rachel Jesudasan · Jose Luis Fernández · Jaime Gosálvez · Ashok Agarwal





Mutation Research 727 (2011) 62–71

Contents lists available at ScienceDirect

Mutation Research/Reviews in Mutation Research

journal homepage: www.elsevier.com/locate/reviewsmr
Community address: www.elsevier.com/locate/mutres

Review

Epigenetics, spermatogenesis and male infertility

Singh Rajender [a], Kelsey Avery [b], Ashok Agarwal [b,*]

[a] Central Drug Research Institute (Council of Scientific and Industrial Research), Lucknow, U.P., India
[b] Centre for Reproductive Medicine, Cleveland Clinic, Cleveland, OH, USA

ANDROLOGY

ISSN: 2047-2919

ANDROLOGY

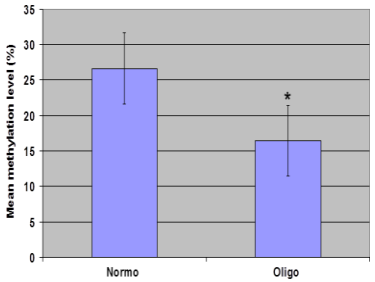
ORIGINAL ARTICLE

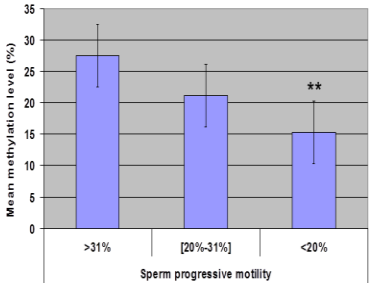
Correspondence:
Debbie Montjean, Hopital Saint-Joseph, Marseille, Service de Medecine et Biologie de la Reproduction, 26 boulevard de Louvain, 13008 Marseille, France.
E-mail: dmontjean@hopital-saint-joseph.fr

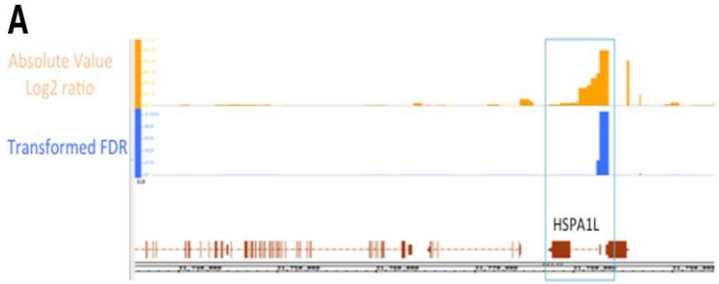
Keywords:
DNA methylation, epigenetics, infertility, semen analysis, sperm quality parameters, spermatozoa

Sperm global DNA methylation level: association with semen parameters and genome integrity

[1]D. Montjean, [2]A. Zini, [3]C. Ravel, [4]S. Belloc, [4]A. Dalleac, [5]H. Copin, [1]P. Boyer, [6]K. McElreavey and [4,5]M. Benkhalifa



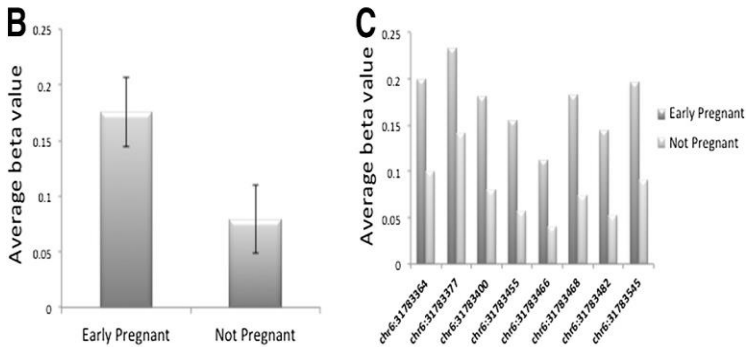


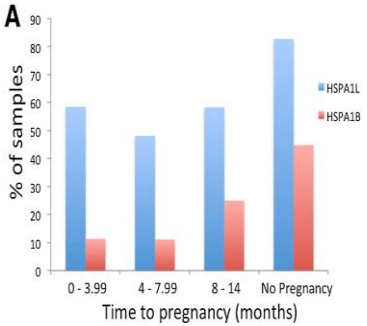


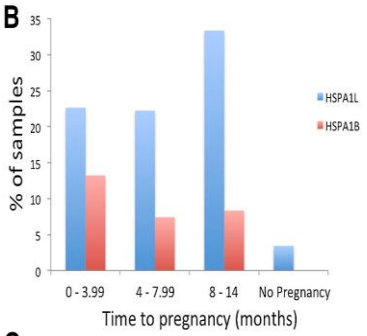
ORIGINAL ARTICLES: ANDROLOGY

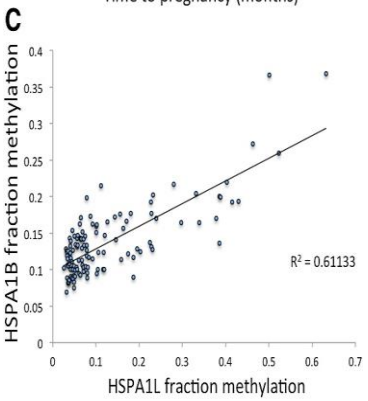
Decreased fecundity and sperm DNA methylation patterns

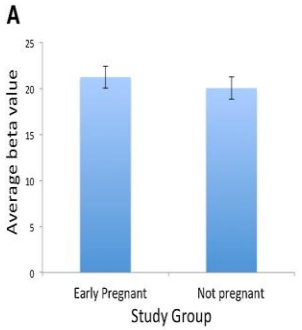
Timothy G. Jenkins, Ph.D.,[a] Kenneth I. Aston, Ph.D.,[a] Tyson D. Meyer, B.S.,[a] James M. Hotaling, M.D., M.S.,[a] Monis B. Shamsi, Ph.D.,[a] Erica B. Johnstone, M.D.,[b] Kyley J. Cox, M.P.H.,[c] Joseph B. Stanford, M.D., M.S.P.H.,[c] Christina A. Porucznik, Ph.D., M.S.P.H.,[c] and Douglas T. Carrell, Ph.D.[a,d,e]

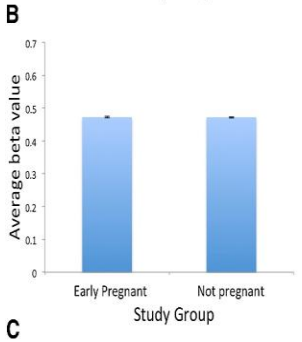


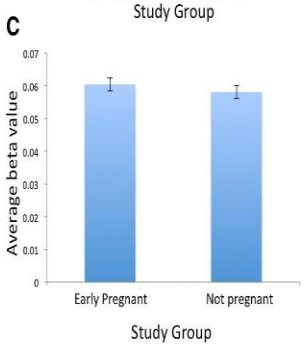


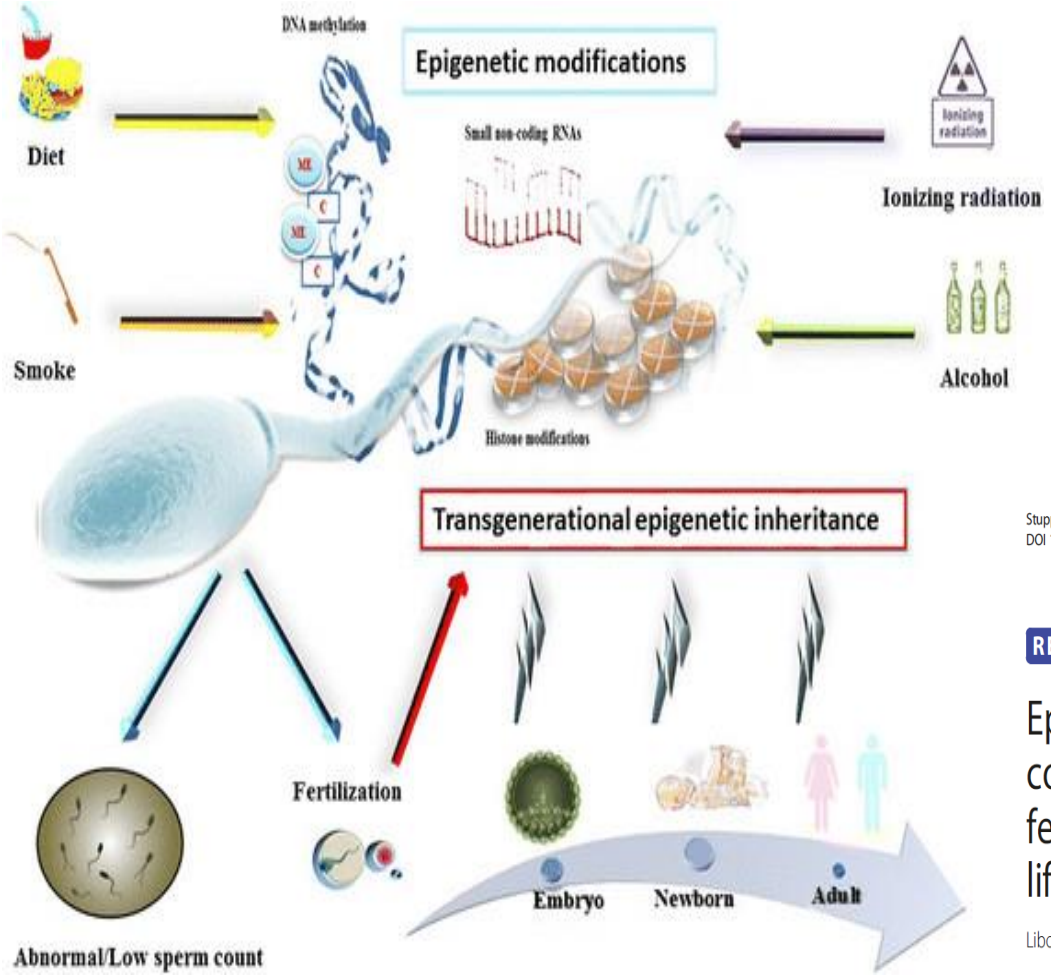












Stuppia *et al. Clinical Epigenetics* (2015) 7:120
DOI 10.1186/s13148-015-0155-4

CLINICAL EPIGENETICS

REVIEW Open Access

Epigenetics and male reproduction: the consequences of paternal lifestyle on fertility, embryo development, and children lifetime health

Liborio Stuppia[1,3*], Marica Franzago[1], Patrizia Ballerini[2], Valentina Gatta[1,3] and Ivana Antonucci[1,3]

Fig. 2 Epigenetic alterations induced by lifestyle and environmental factors (diet, smoking, radiation, alcohol consumption, etc.) can have substantial effects on the sperm function. As a first consequence, these modifications can induce sperm alterations leading to impairment of male fertility. When fertilization occurs, spontaneously or by ART, transgenerational epigenetic effects can be observed, in details leading to (1) alterations of embryo development, (2) congenital diseases at birth, and (3) late onset diseases (obesity, hypertension, diabetes, etc.) in the adult life