Epigenetics in Paediatrics

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Introduction

What is epigenetics?

- Epigenetics is a new aspect in Genetics
- It opens a new window in medical treatments, preventions and public health
- Epigenetics tells a new story in gene regulation
What is epigenetics?...

- In other words it is a turn on and off key for gene expression
- Epigenetics is the key mediator between our environment and our genome
- Here I will briefly summarise its role in some paediatrics topics including: stress, obesity, diabetes, cancer and autism.
Epigenetics Mechanisms

- Development (in utero, childhood)
- Environmental chemicals
- Drugs
- Aging
- Diet

Health Endpoints

- Cancer
- Autoimmune disease
- Mental Disorders
- Diabetes
What is Epigenetics?

Epigenetics regulates gene activity without altering DNA sequence.

DNA methylation:
Methyl group (an epigenetic factor found in some dietary sources) can tag DNA and activate or repress genes.

Histones are proteins around which DNA can wind for compaction and gene regulation.

Histone modification:
The binding of epigenetic factors to histone “tails” alters the extent to which DNA is wrapped around histones and the availability of genes in the DNA to be activated.
The main mediator in epigenetics is the environment.
Genes transfer our ancestor's phenotype while epigenetics transfer their experiences to us.
Stress load can modify Gene expression
Risk of: Cancer, Obesity, Autism, Diabetes...

Environment

Epigenetics

Microbiome

Fetal Health

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

- Maternal Stress
- Blood Vessels
- Heart
- Kidneys
- HPA axis
- Brain
- Liver
- Muscle
- Pancreas

**Obstetric Diseases**

**Postnatal**

- Cardiovascular Diseases
  - Hypertension
  - Coronary Heart Disease
  - Heart Failure

- Neurological Diseases
  - Neurobehavioral Disease
  - Neuropsychological Disease
  - Neuropsychiatric Disease
  - Stroke

- Metabolic Diseases
  - Obesity
  - Diabetes Type 2
  - Hyperlipidemia
Epigenetic alterations

- Preterm birth
- Metabolic disturbance
- Immune
- Nervous
- Endocrine
- Altered behavior

Prenatal stress
What happens in stressful situations?

- Adverse Events & Trauma = Toxic stress
- Allostatic load
- Catastrophization
- Depression
- Disease
- Epigenetic?
- Inflammatory?
- Neurobiological?
- Changes
- Childhood
- Adulthood
- Future generations
- Offspring
The same genome but different Epigenetics
Diabetes & the effect of Epigenetics

Epigenetics
- DNA methylation
- Histone modifications
- MicroRNAs

Type 2 Diabetes

Genetics
- Heritability of epigenetics changes
- Family history of diabetes

Environment
- Aging
- Stress
- Unhealthy diet
- Physical inactivity
- Intrauterine environment
- Maternal nutrition
- Built environment
Asthma

Allergens through our environment

Allergens act as epigenetic activators
The role of epigenetics in Asthma Cycle
Autism & Epigenetics regulation