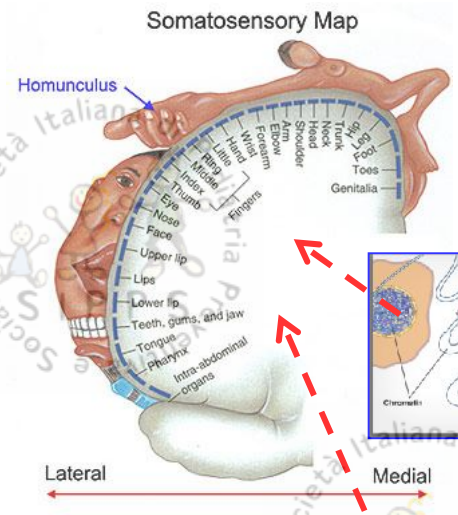
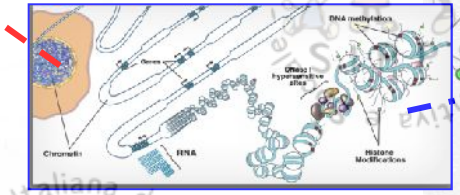
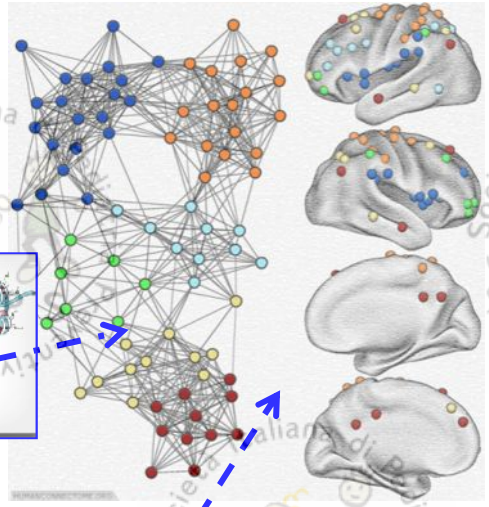
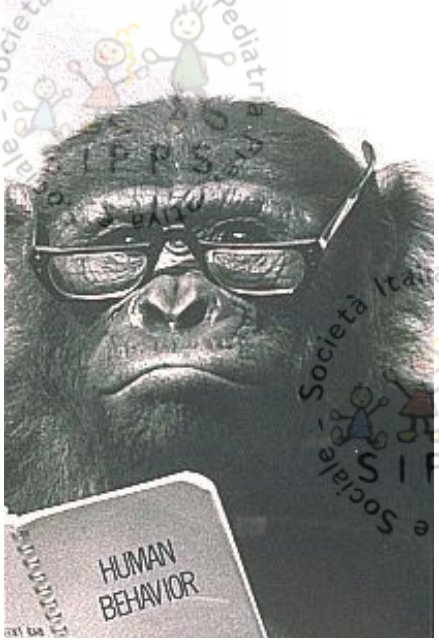




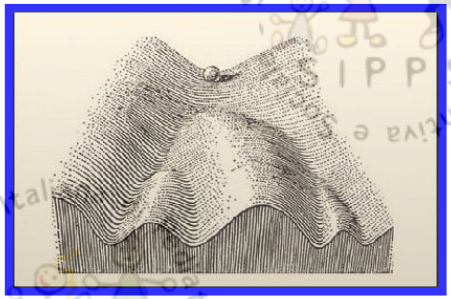


From GENETICS to EPIGENETICS

.. to Primary Prevention



ECERI
European Cancer and Environment Research Institute



INTERNATIONAL SOCIETY OF DOCTORS FOR ENVIRONMENT
ISDE

ERNESTO BURGIO
ISDE Scientific Committee
ECERI - European Cancer and Environment Research Institute

Prevenzione (pre)primaria delle patologie complesse: dalla genetica all'*epigenetica*

E Burgio

Punto 1 Slides 2-8 (1 minuto)

***PUB MED* (incremento esponenziale pubblicazioni** su:

Epigenetics/Cancer Genomics/Obesity/Autism/Microbiome/ EDCs

Punto 2 Slides 9-11 (2 minuti)

The 7 Key Words from *genetics* to *EPIGENETICS*

Punto 3 Slides 12-25 (2 minuti)

The *Epidemiological Transition*

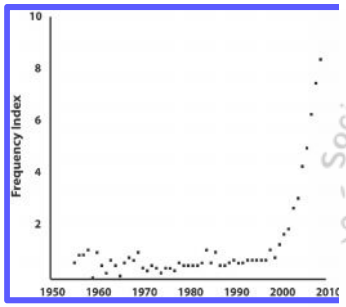
Punto 4 Slides 26-37 (2 minuti)

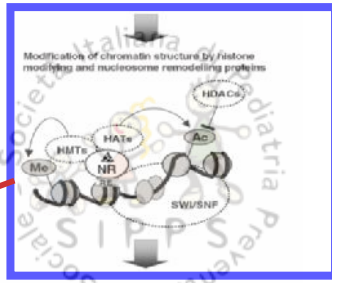
The other 6 words: from genetics to epigenetics to *DOHaD*

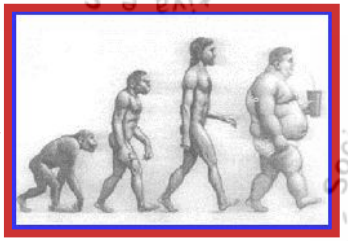
(Developmental Origins of Health and Diseases)

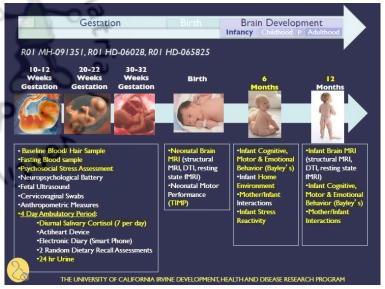
Punto 5 Slides 38-40 (1 minuto)

From DOHaD to *Primary Prevention*





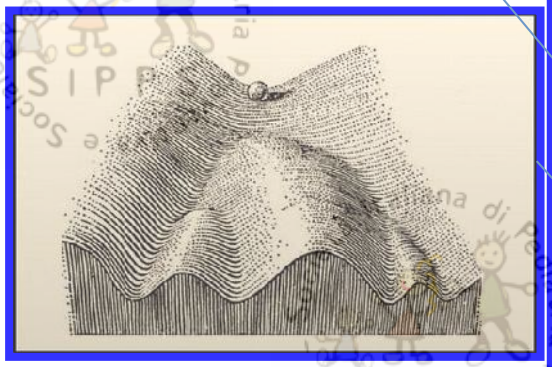


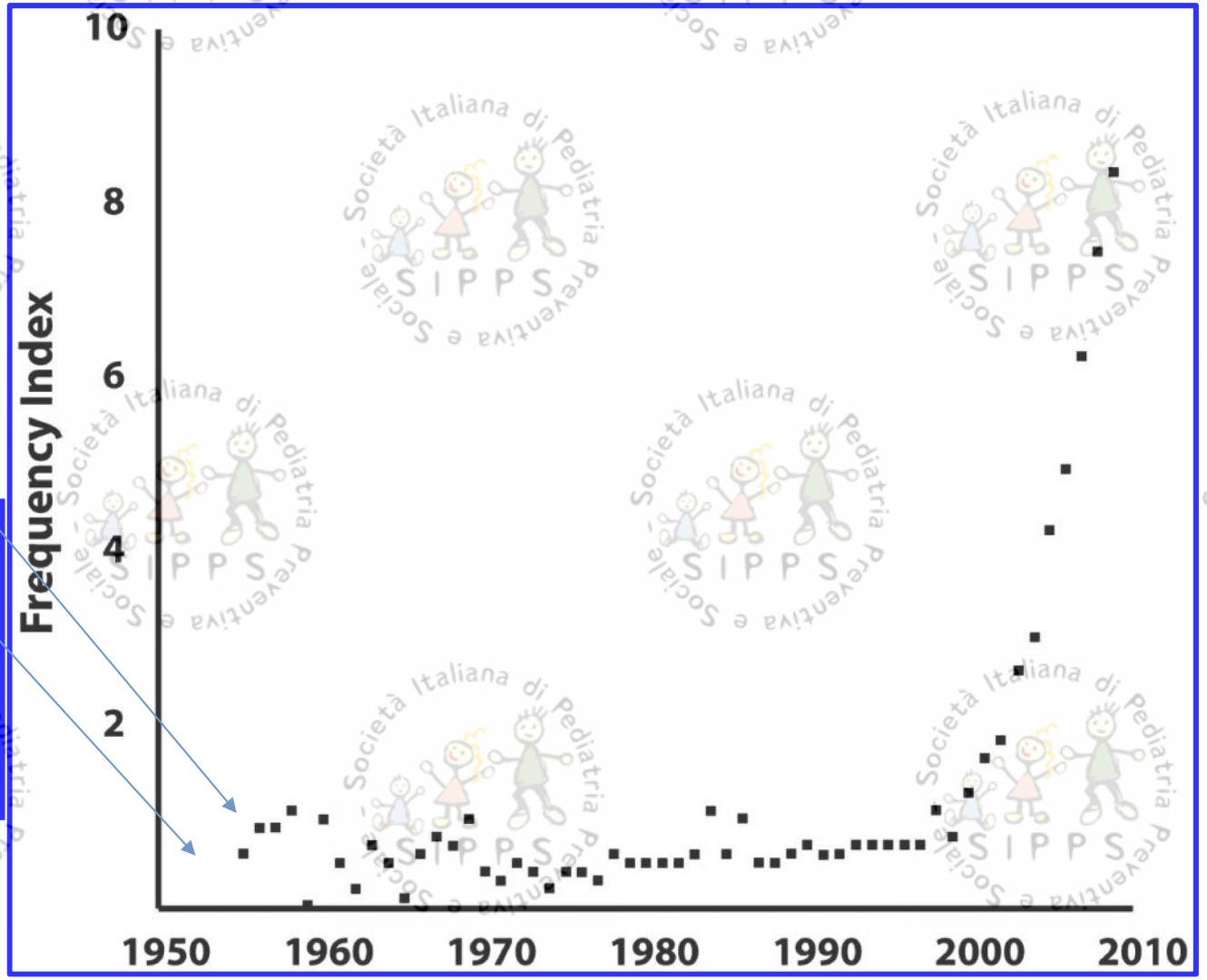


Relative frequency of articles with the term *epigenetic* or *epigenetics* in their title

David Haig Int. J. Epidemiol. 2012;41:13-16

Foreword 1





Relative frequency of articles with epigenetic or epigenetics in their title

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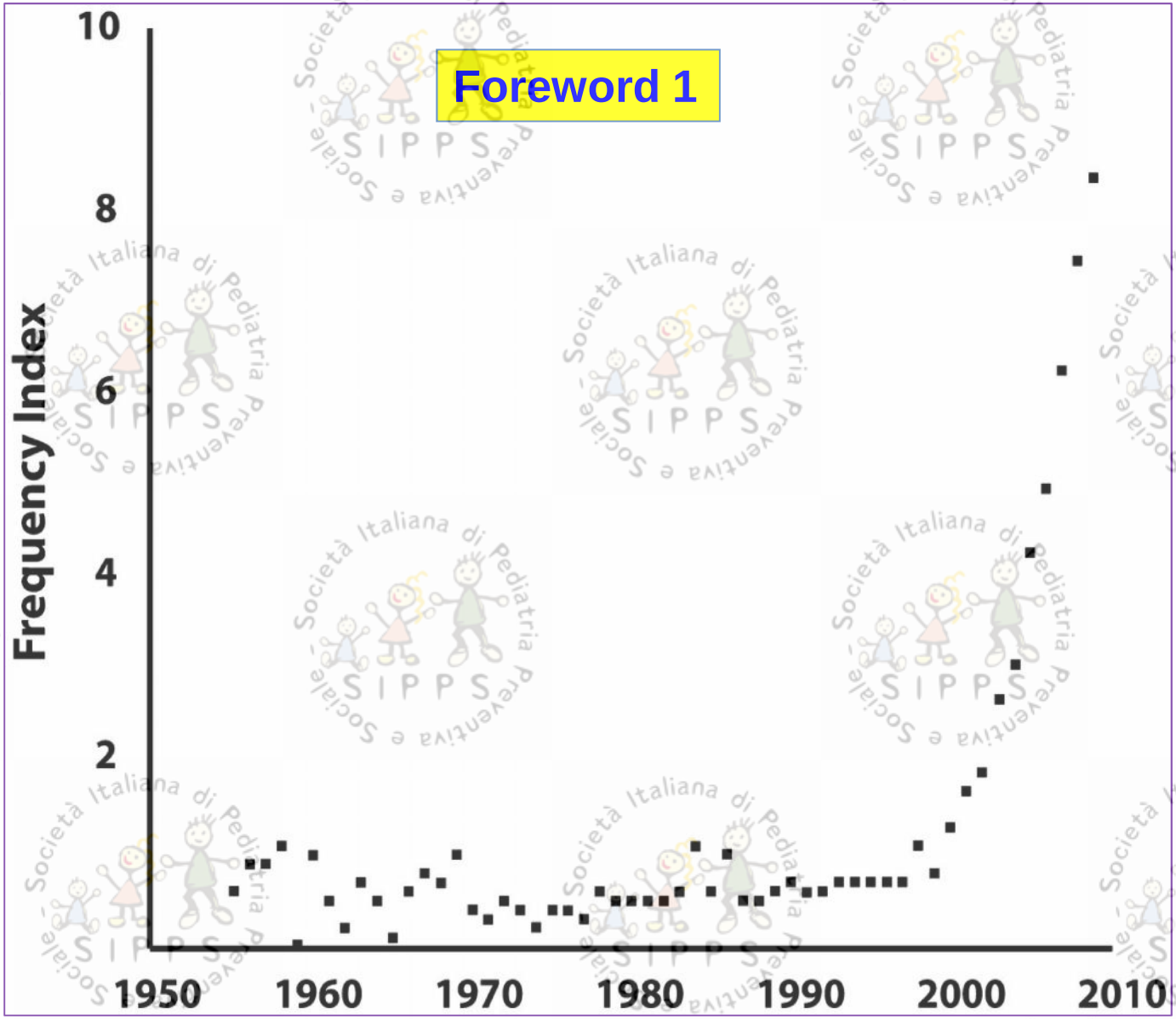
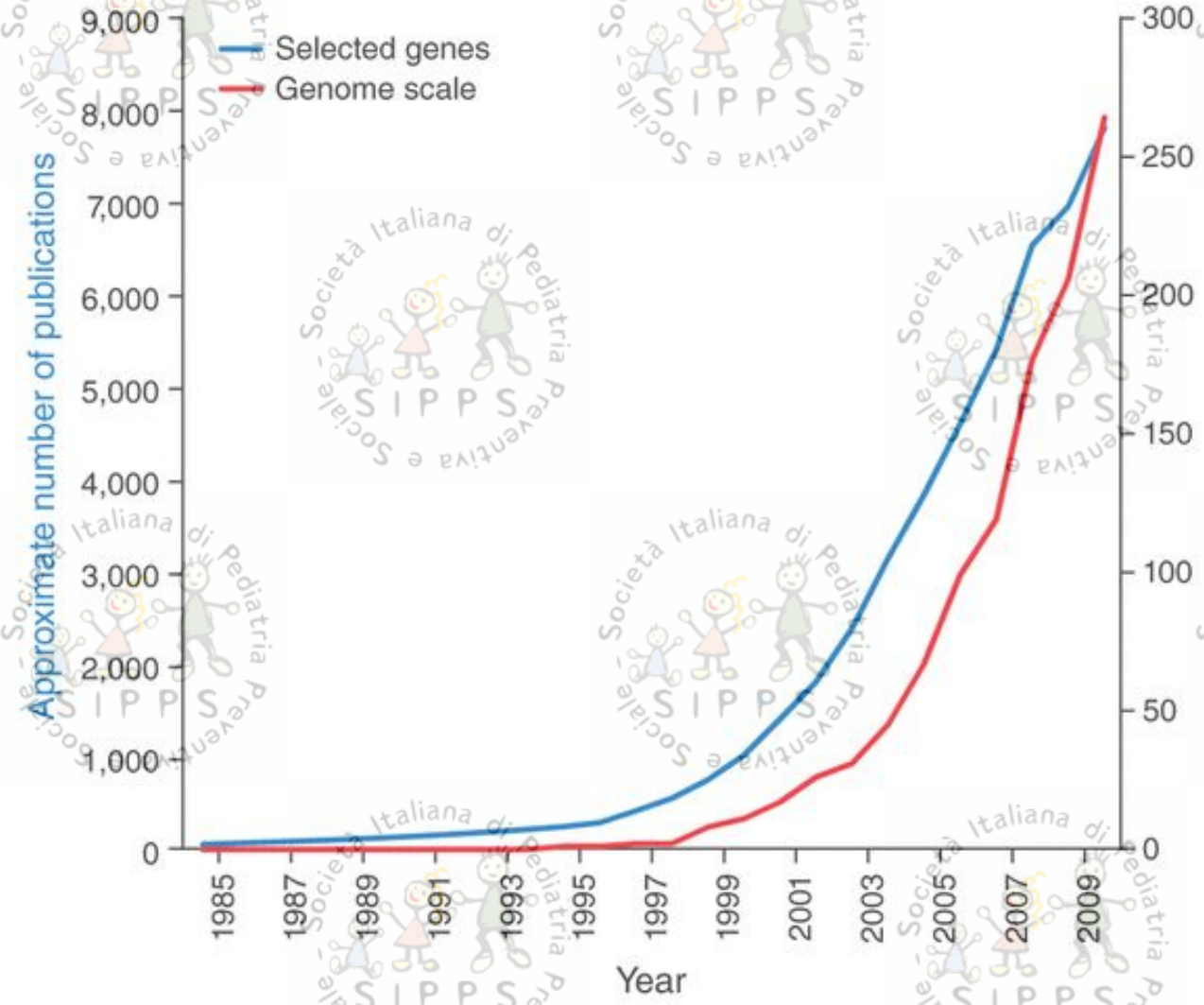
Foreword 1

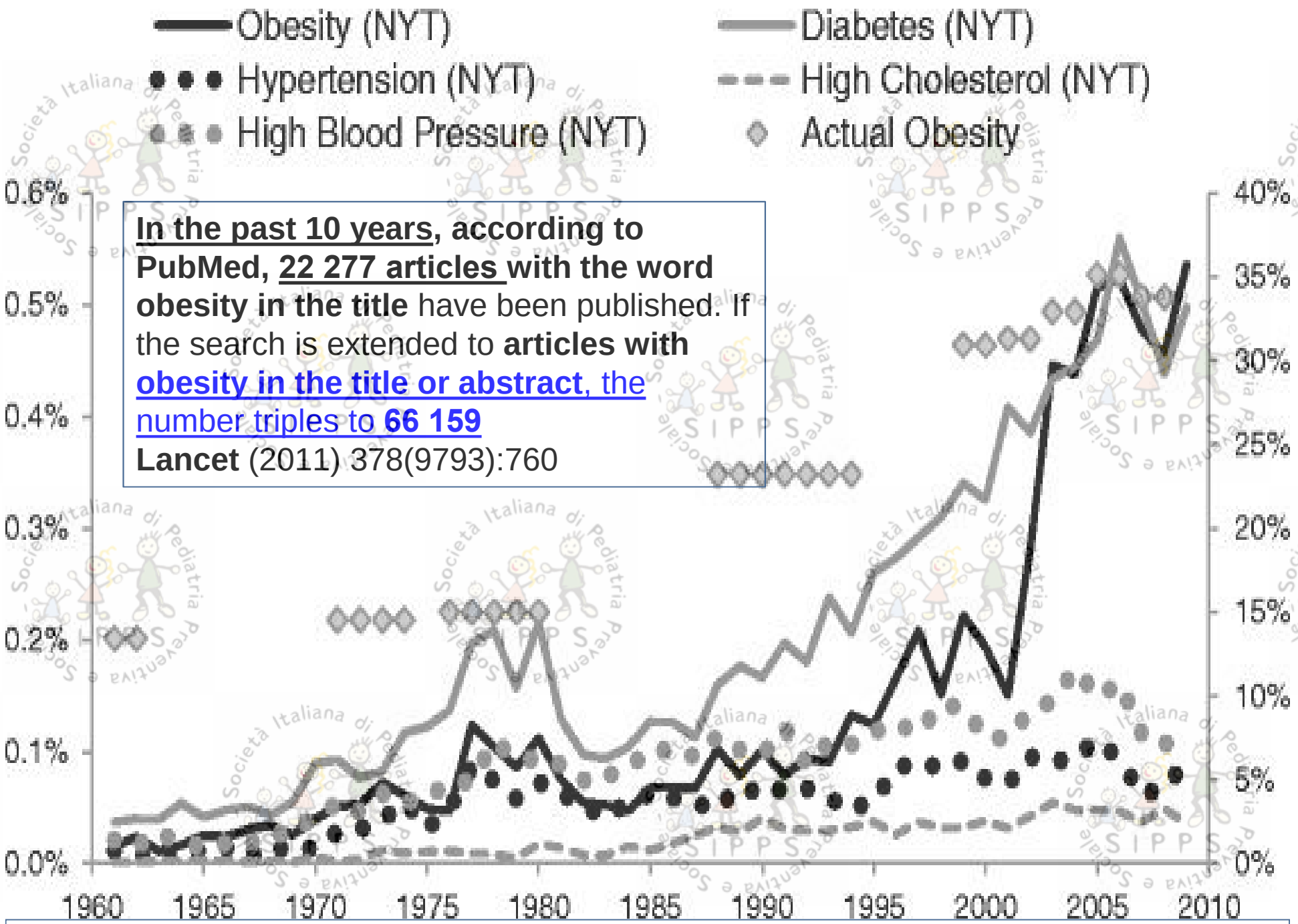


International Journal of Epidemiology



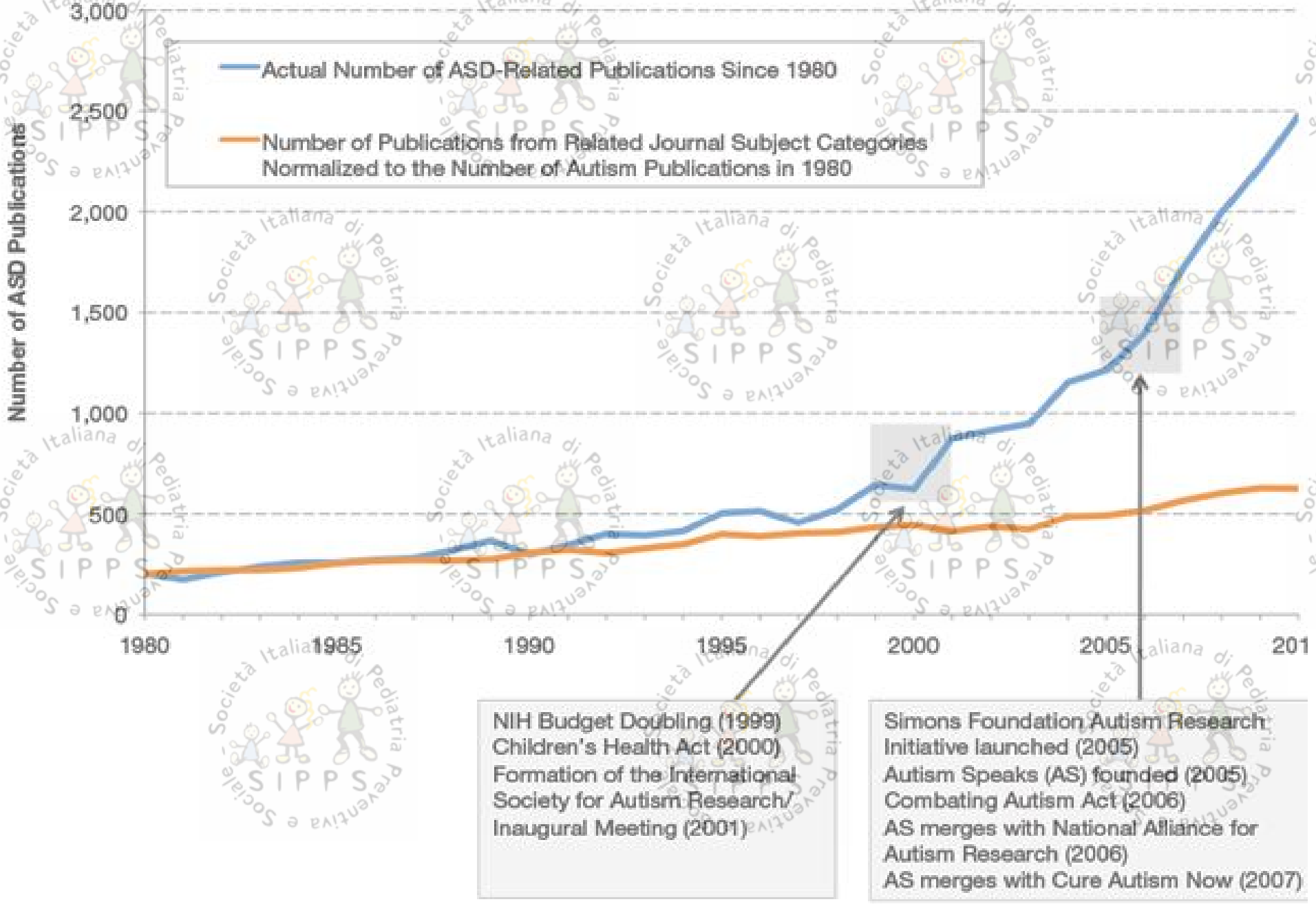
The rate of increase of **genome-scale publications addressing cancer genetics** has become greater than that of **publications in the same area focused on selected genes**

Feinberg AP **Epigenomics reveals a functional genome anatomy and a new approach to common disease** Nature Biotechnology 28, 1049–1052 (2010)

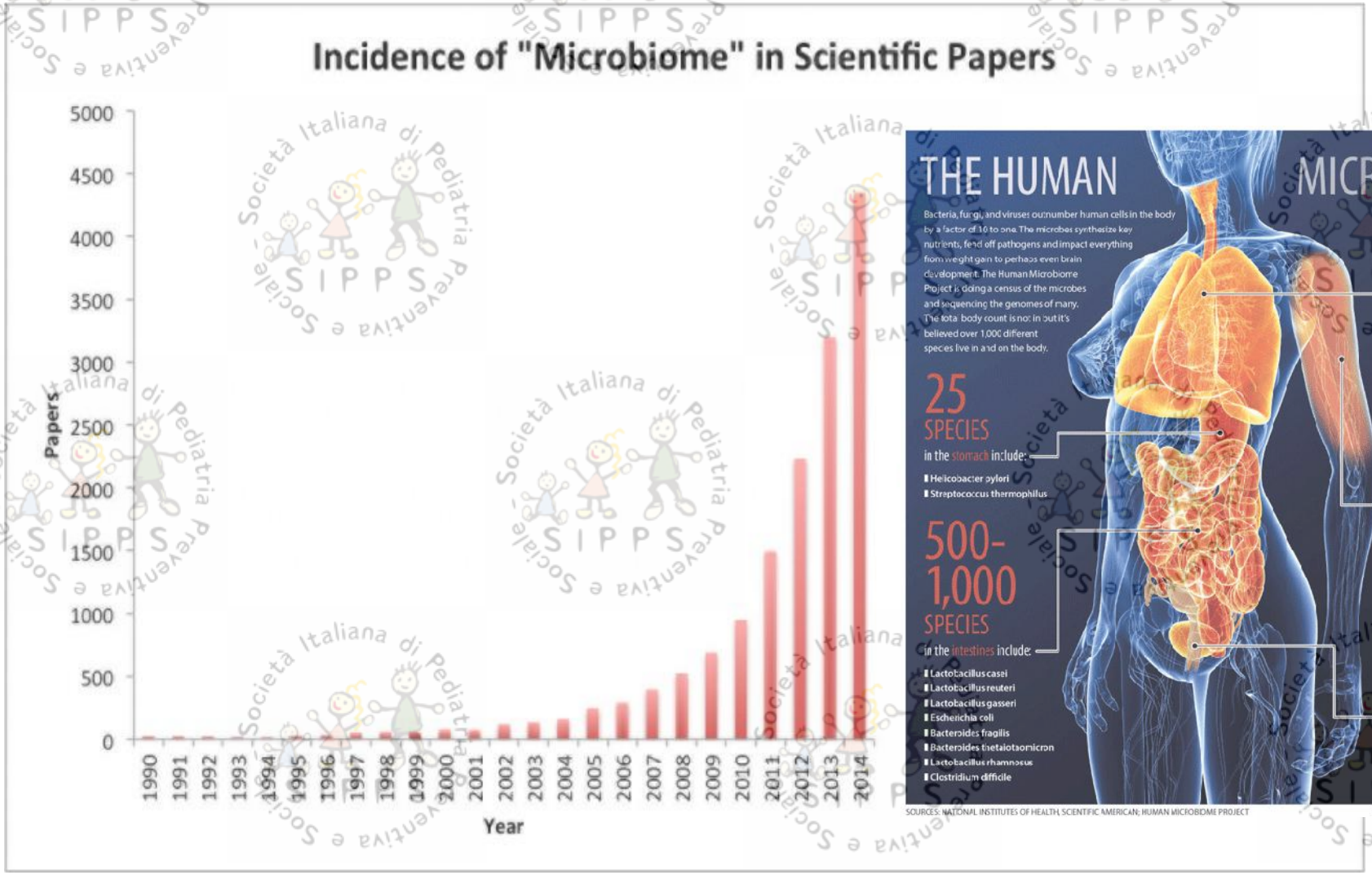


In the past 10 years, according to PubMed, 22 277 articles with the word obesity in the title have been published. If the search is extended to **articles with obesity in the title or abstract**, the number triples to **66 159**
Lancet (2011) 378(9793):760

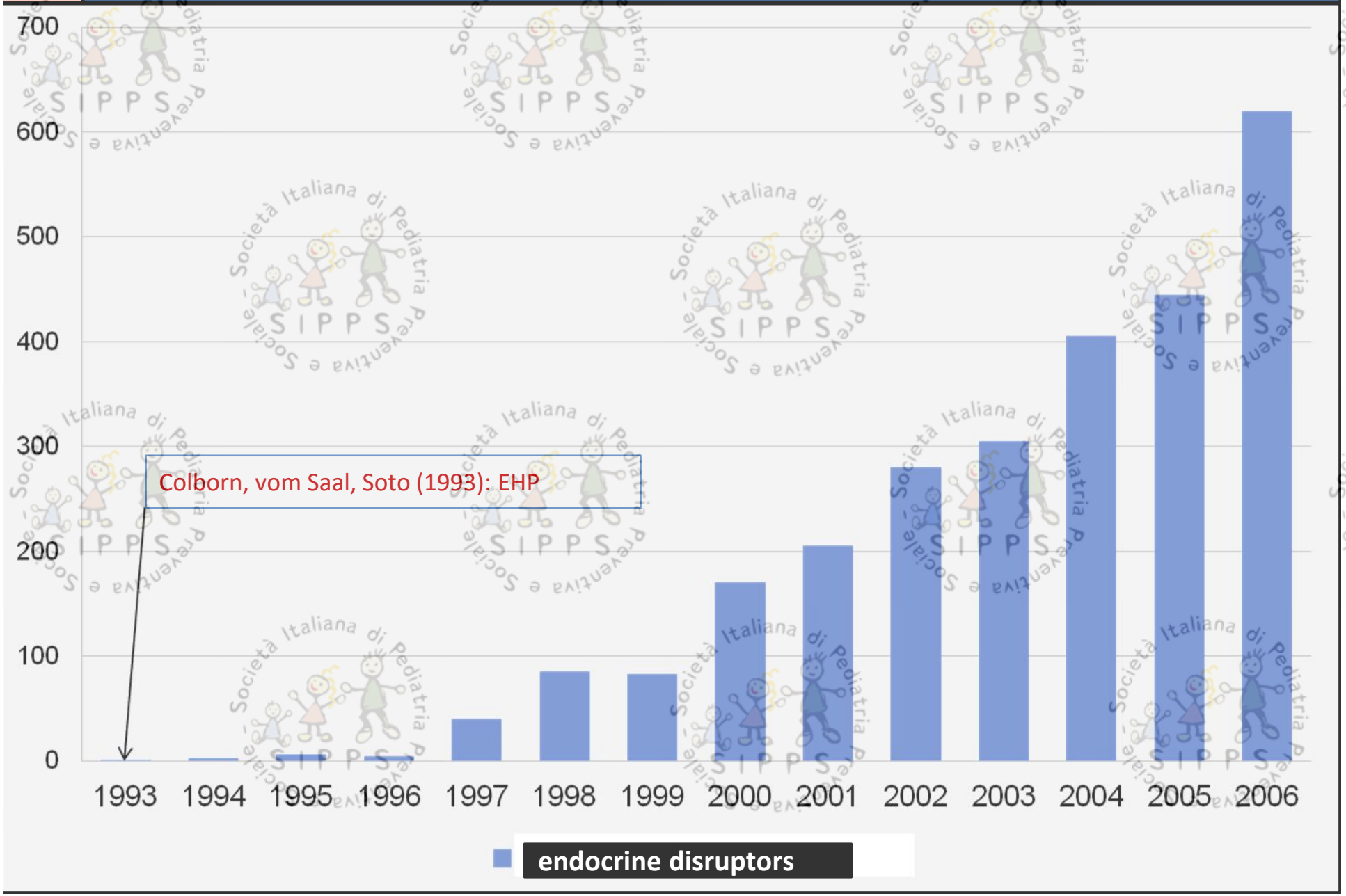
Number of *New York Times* articles mentioning obesity and related comorbidities


Actual Number of ASD-Related Publications Since 1980
Number of Publications from Related Journal Subject Categories Normalized to the Number of Autism Publications in 1980
Number of ASD Publications
3,000
2,500
2,000
1,500
1,000
500
0
1980
1985
1990
1995
2000
2005
201
NIH Budget Doubling (1999)
Children's Health Act (2000)
Formation of the International Society for Autism Research/ Inaugural Meeting (2001)
Simons Foundation Autism Research Initiative launched (2005)
Autism Speaks (AS) founded (2005)
Combating Autism Act (2006)
AS merges with National Alliance for Autism Research (2006)
AS merges with Cure Autism Now (2007)

*A quick search for "**Microbiome**" in **scienctific journals online** demonstrates how significantly this field of research has been **growing over the past ten years***

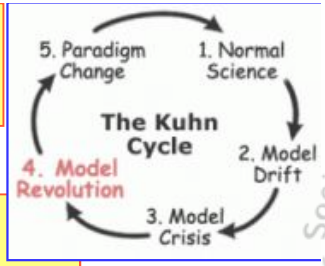


Published papers about endocrine disruptors between 1993 and november 2006 (Gies)



Foreword 2

We are currently facing a *paradigm shift* in biomedicine

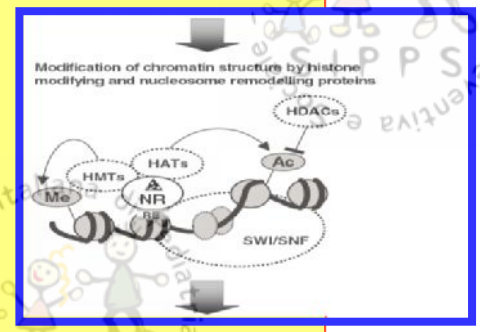


For the last 50 years it was agreed to consider **DNA as the code and the key project for the assembly of our phenotype**.

In the last ten years and especially since the appearance of **the first molecular epigenetic studies** we have begun to understand

that **the construction of the phenotype is the result of the interaction** between the **information** coming from the **environment**

and the **information** deeply inscribed **inside the DNA**

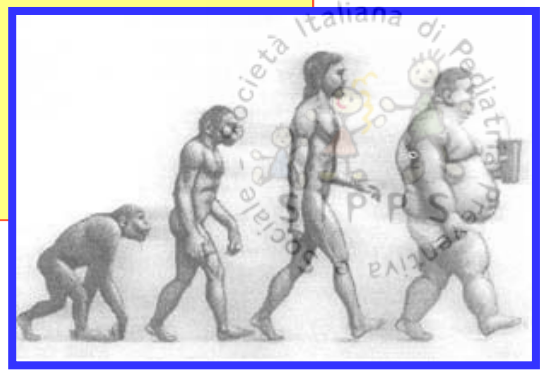


thanks to a very complex molecular network surrounding the DNA: the *epigenome*

⇩

Therefore it can be argued that there is **no stable change in our phenotype (both physiological and pathological)** which is not

- ***environmentally*** induced
- ***modulated* by the *epigenome***
- ***conditioned*** by the DNA

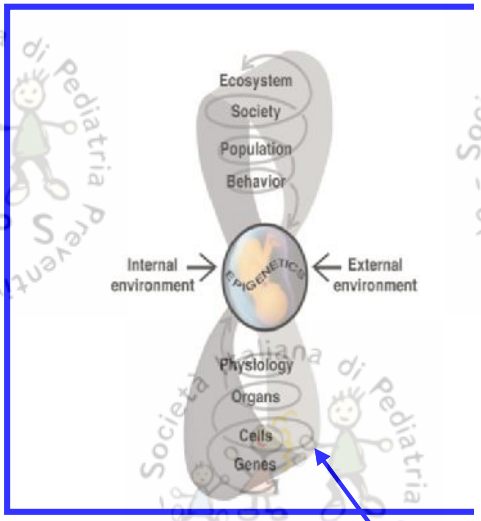


Other **key concepts** (obviously interdependent) are:

- ***developmental plasticity***
- ***fetal programming***

allow ing us to understand how **the fetus epigenetically program (for life) all its cells in a *predictive* and *adaptive* way**

responding to information coming from the *environment* (through the ***mother bias***)



It is important to note that during this period

***incorrect information* (*pollutants, endocrine disruptors* ..)** and /or

discrepancies between the **information** that the baby receives before and after birth **(*mismatch*)**

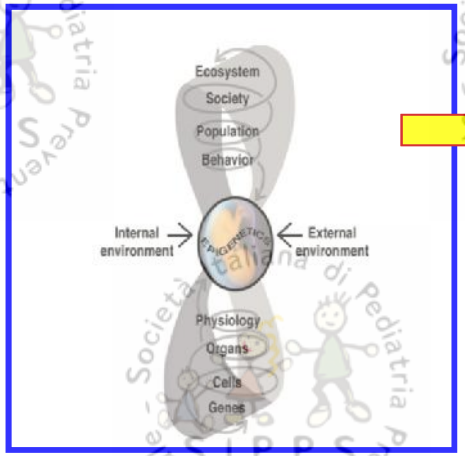
may create **epigenetically bad programmed cells** (including **gametes**), thus causing **chronic diseases in adulthood** or **even in subsequent generations**

This theory (***DOHaD Developmental Origins of Health and Disease***) could help us to **explain the current epidemiological transition** ..

Fetal programming

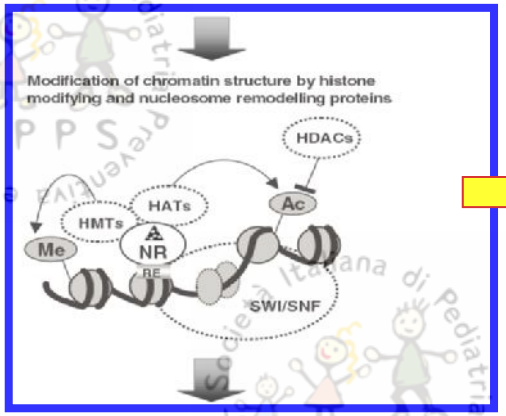
Ontogeny

3



4

Developmental Plasticity

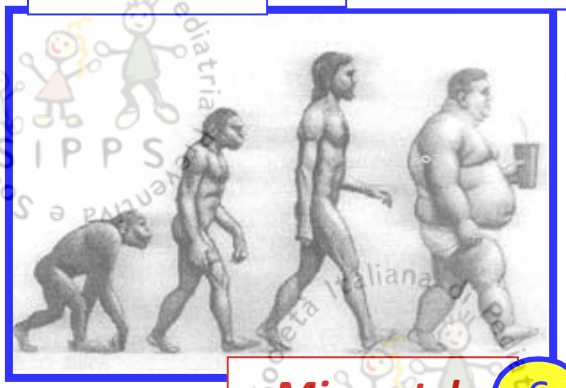


Evolutionary Medicine

5

Phylogeny

Devo-Evo

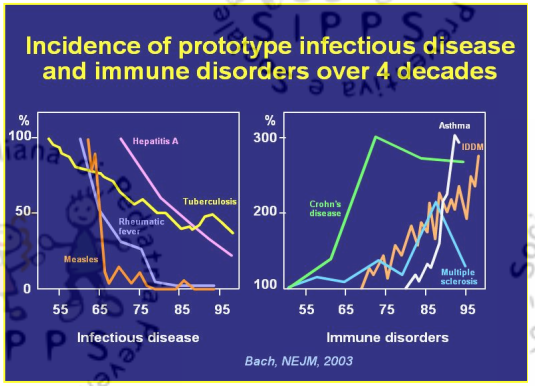


Mismatch

6

7

The *XXI Century Epidemiological Transition*



2

Environment

1

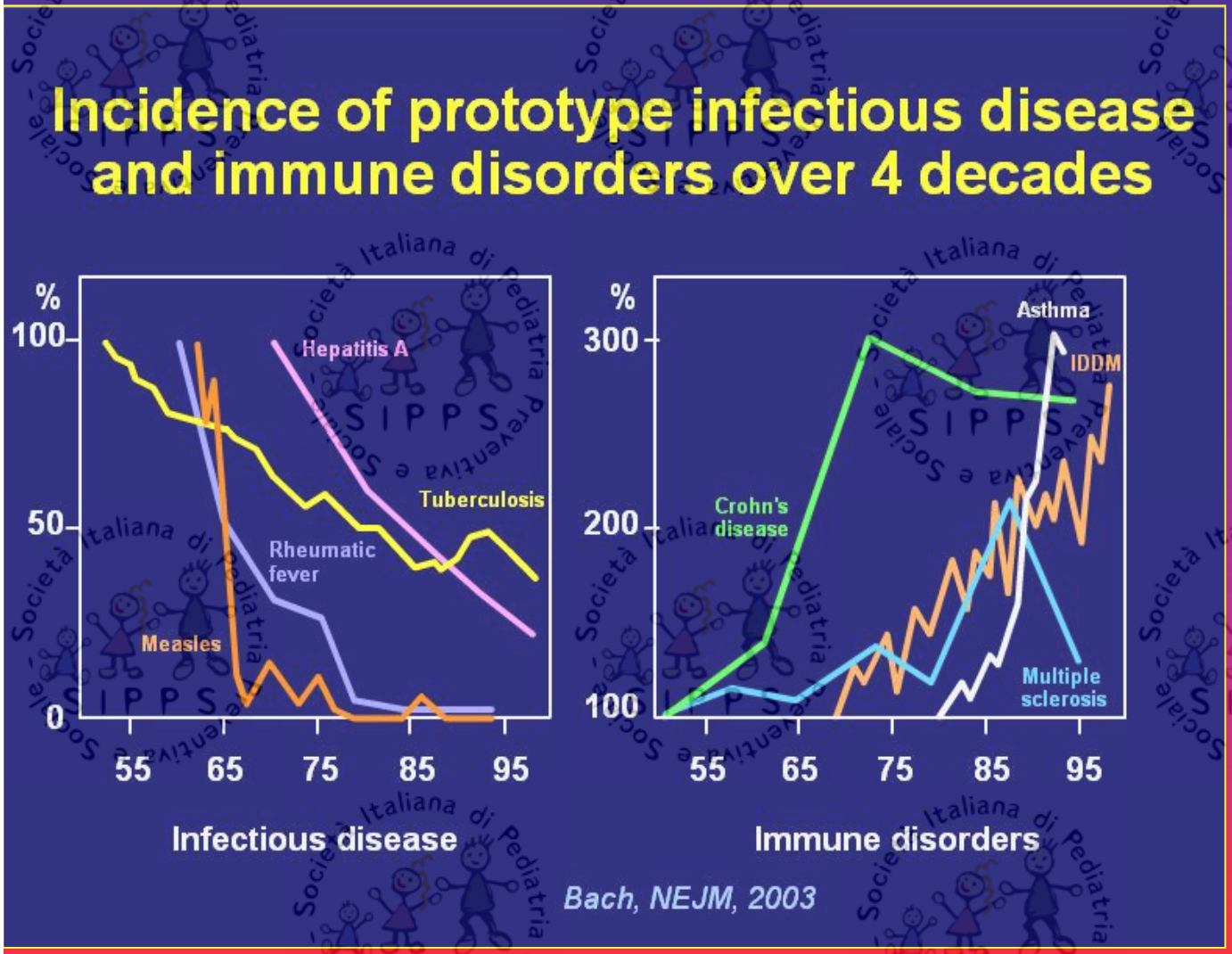
From Genetics to Epigenetics

Is there a ***Project ?***

La transizione epidemiologica del XXI secolo: dalla genetica all'epigenetica

ERNESTO BURGIO
ISDE Scientific Committee
ECERI - European Cancer and Environment Research Institute

Le septième mot clé: La ***transition épidémiologique*** du XXI siècle



<u>Pandemie d'obésité</u>, syndrome métabolique diabète II

Allergies
maladies
auto-immunes
(diabète de type I, maladie coeliaque),

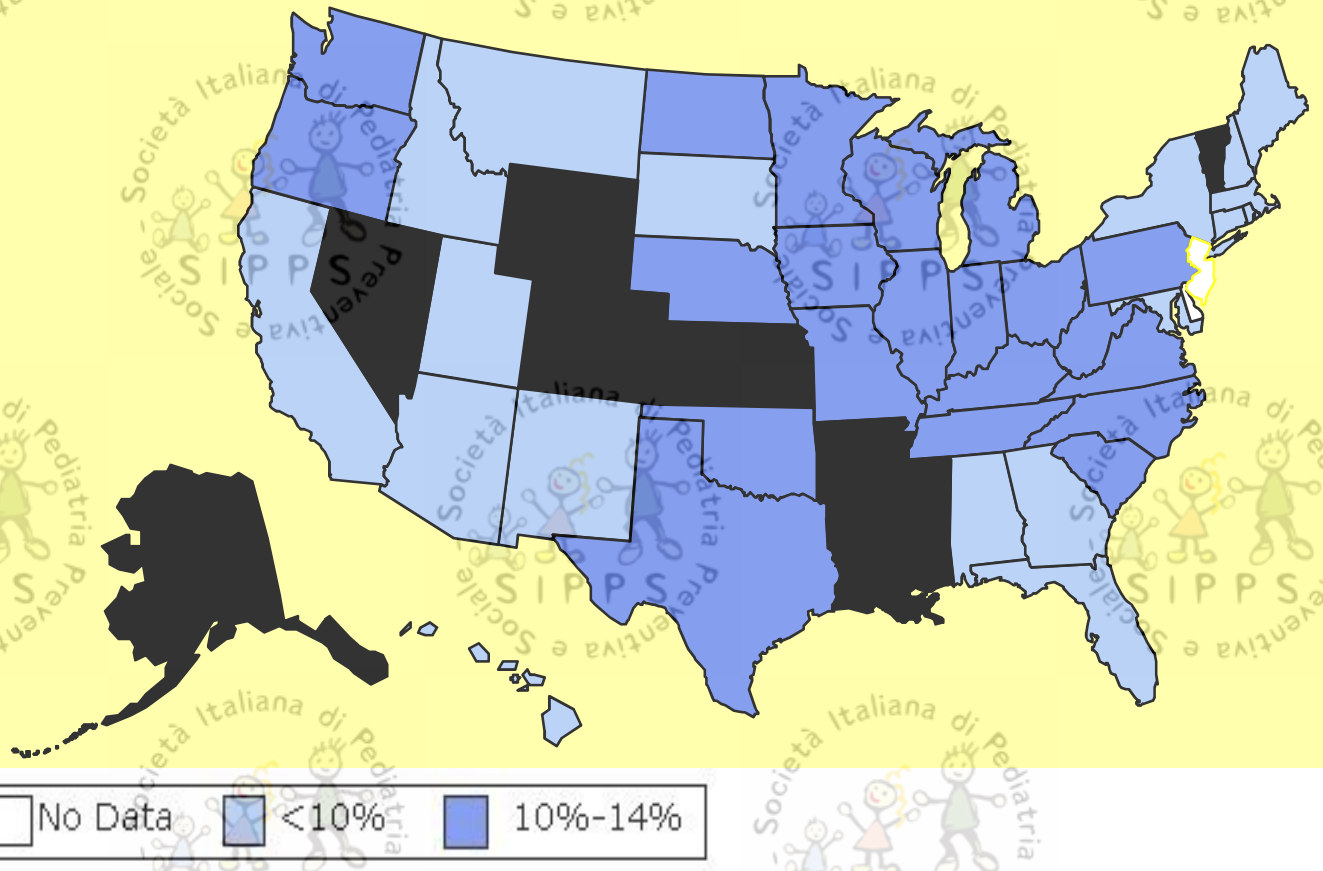
Athérosclérose

<u>Troubles du **neurodéveloppement**</u>
<u>neurodegeneratives</u>

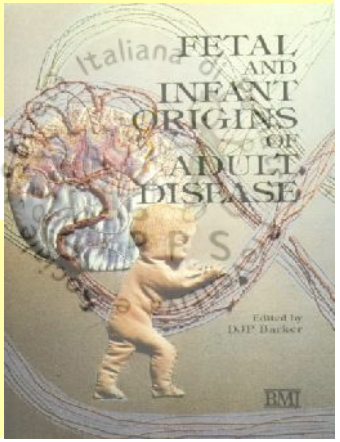
<u>Cancer</u>.

Obesity Trends* Among U.S. Adults 1989

(*BMI ≥30, or ~ 30 lbs overweight for 5'4" woman)



Source: Mokdad A H, et al. J Am Med Assoc 1999;282:16, 2001;286:10.



Obesity Trends* Among U.S. Adults 2001

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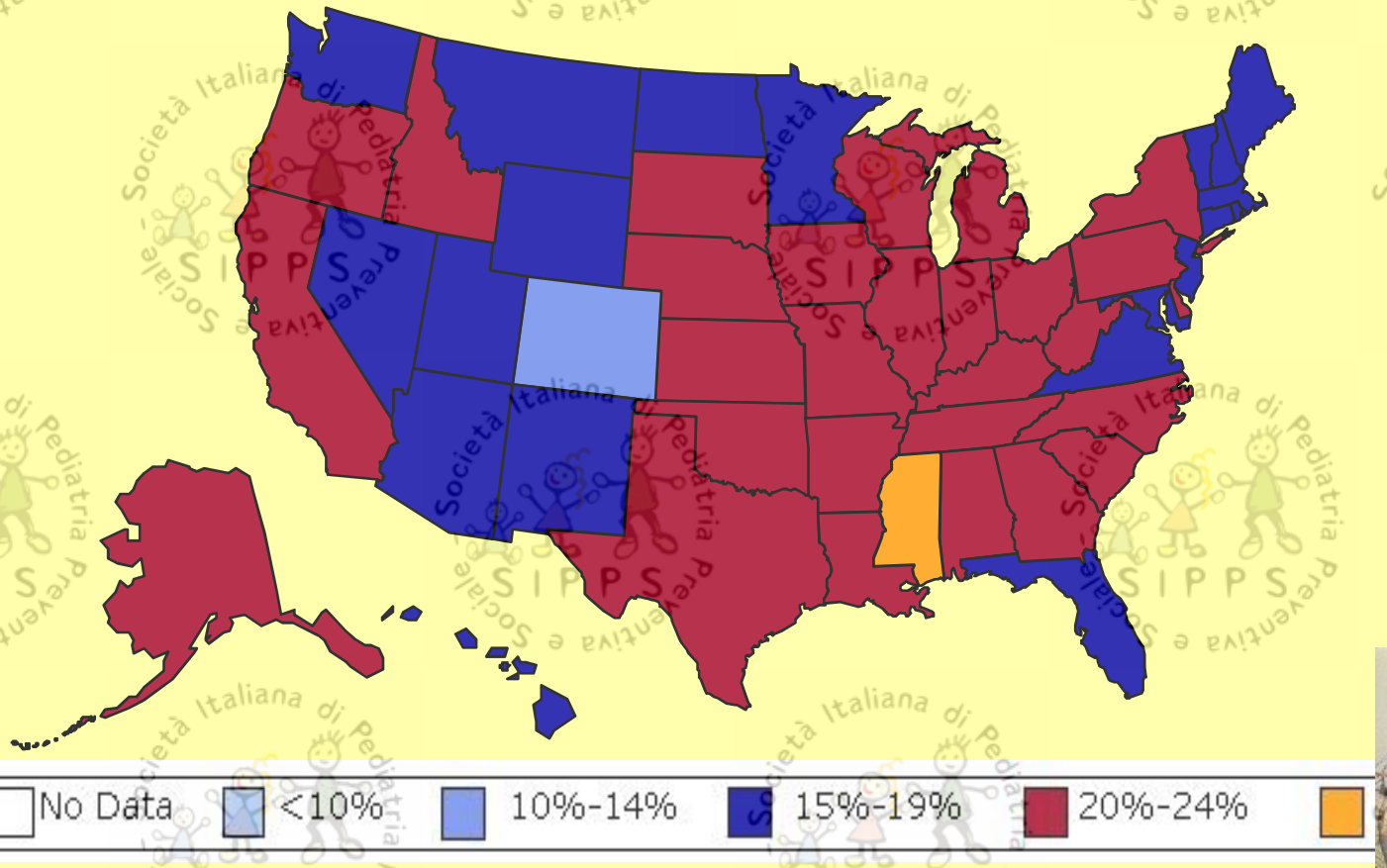
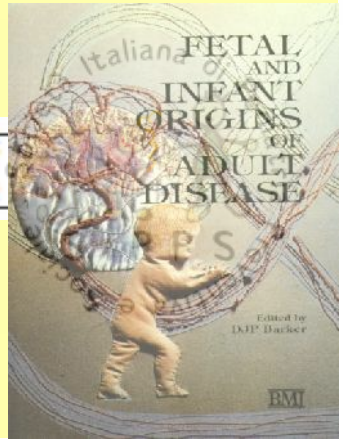


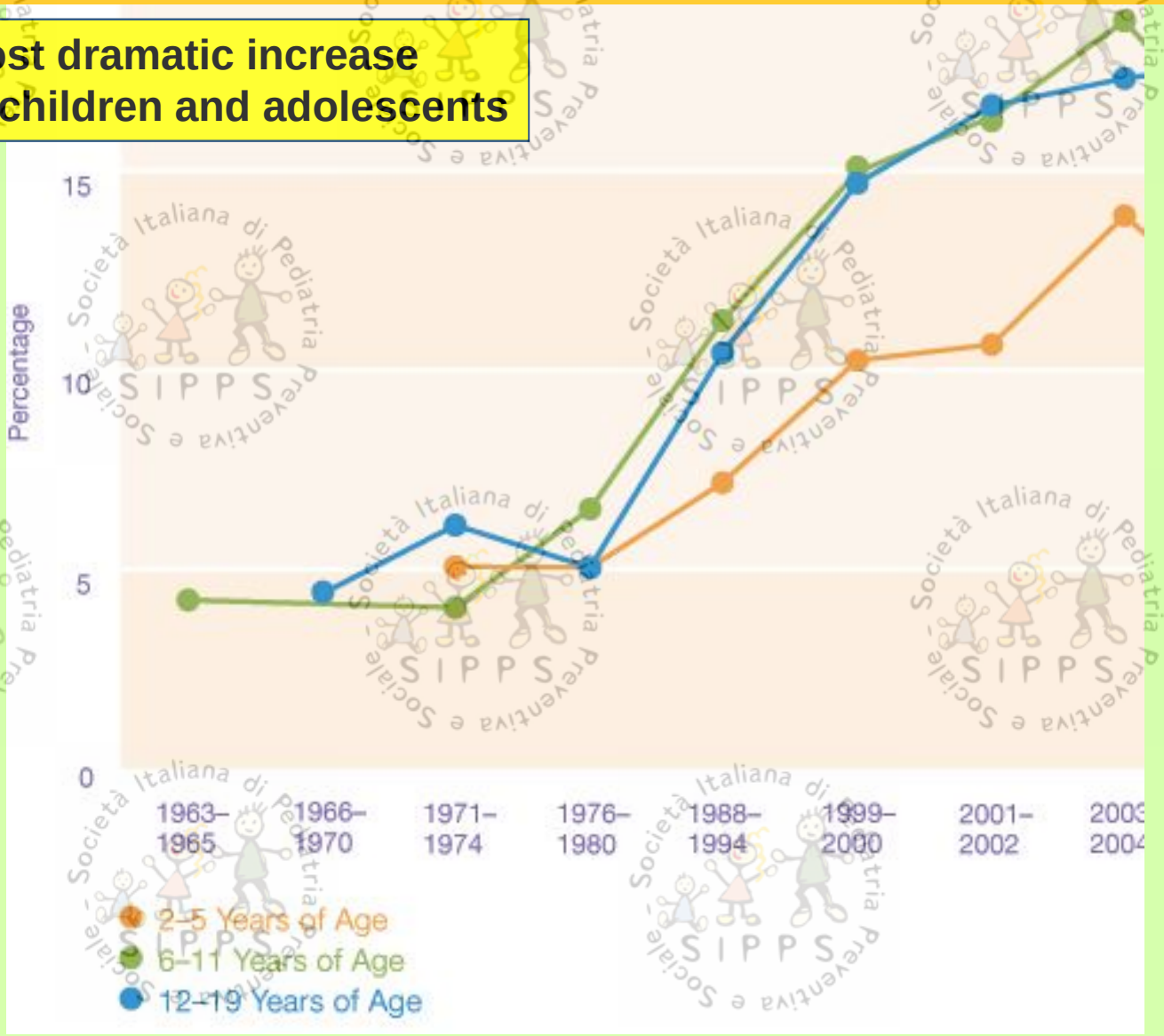
Source: Mokdad A H, et al. J Am Med Assoc 1999;282:16, 2001;286:10.



The Childhood Obesity Epidemic

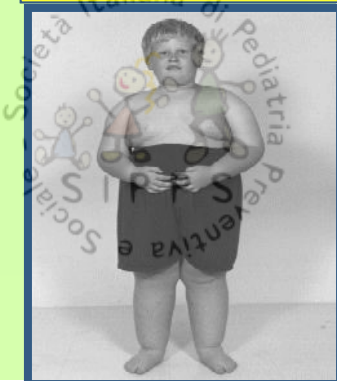
Matthew W. Gillman, MD, SM

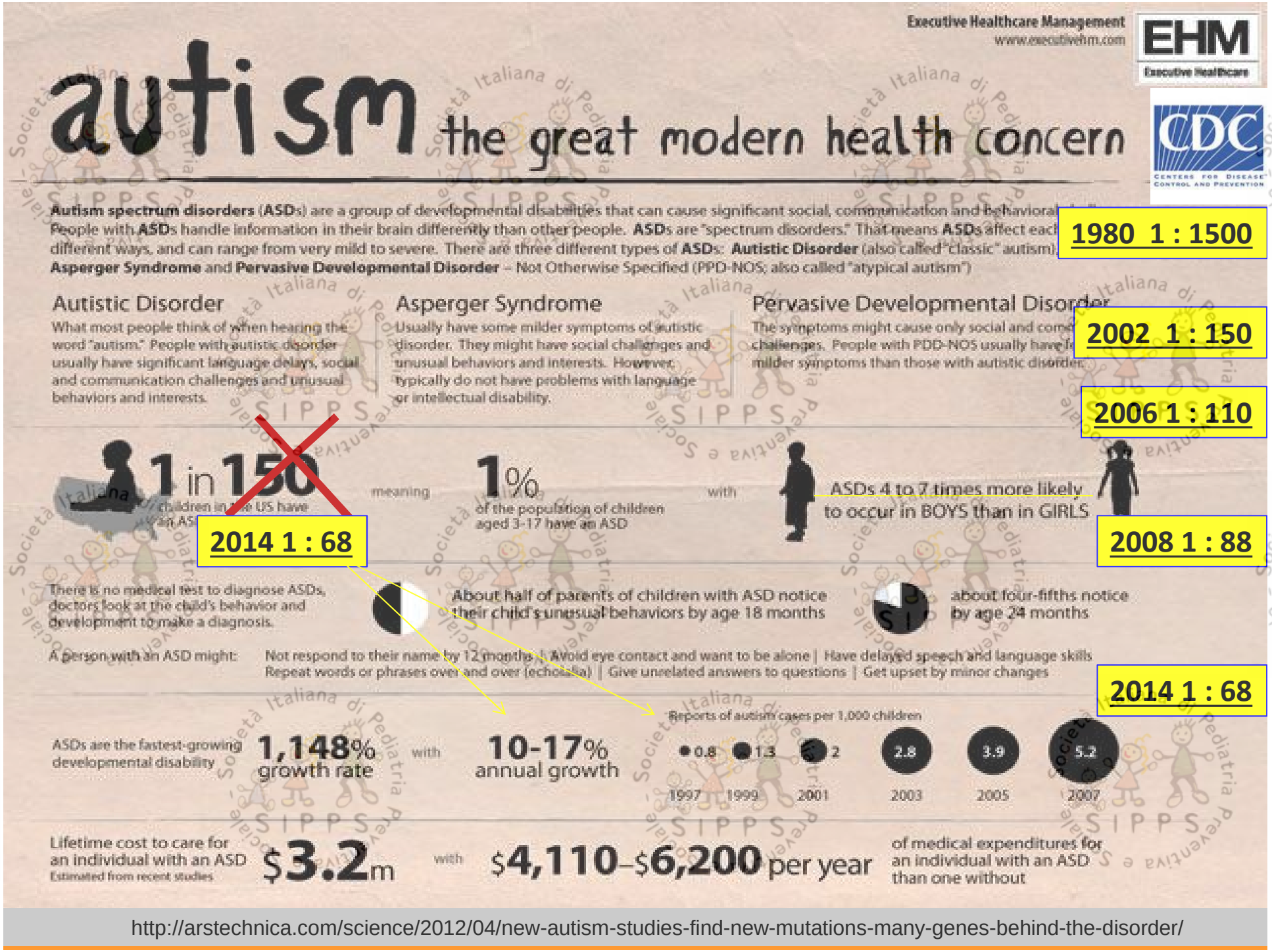
Yet the **most dramatic increase concerns children and adolescents**



US DHHS, 2001; Hedley et al., 2004; Ogden et al., 2006, 2008

<u>in the 70s</u> childhood obesity virtually did not exist (it was associated with **rare genetic syndromes**): since then the increase has been **rapid and relentless**





http://arstechnica.com/science/2012/04/new-autism-studies-find-new-mutations-many-genes-behind-the-disorder/

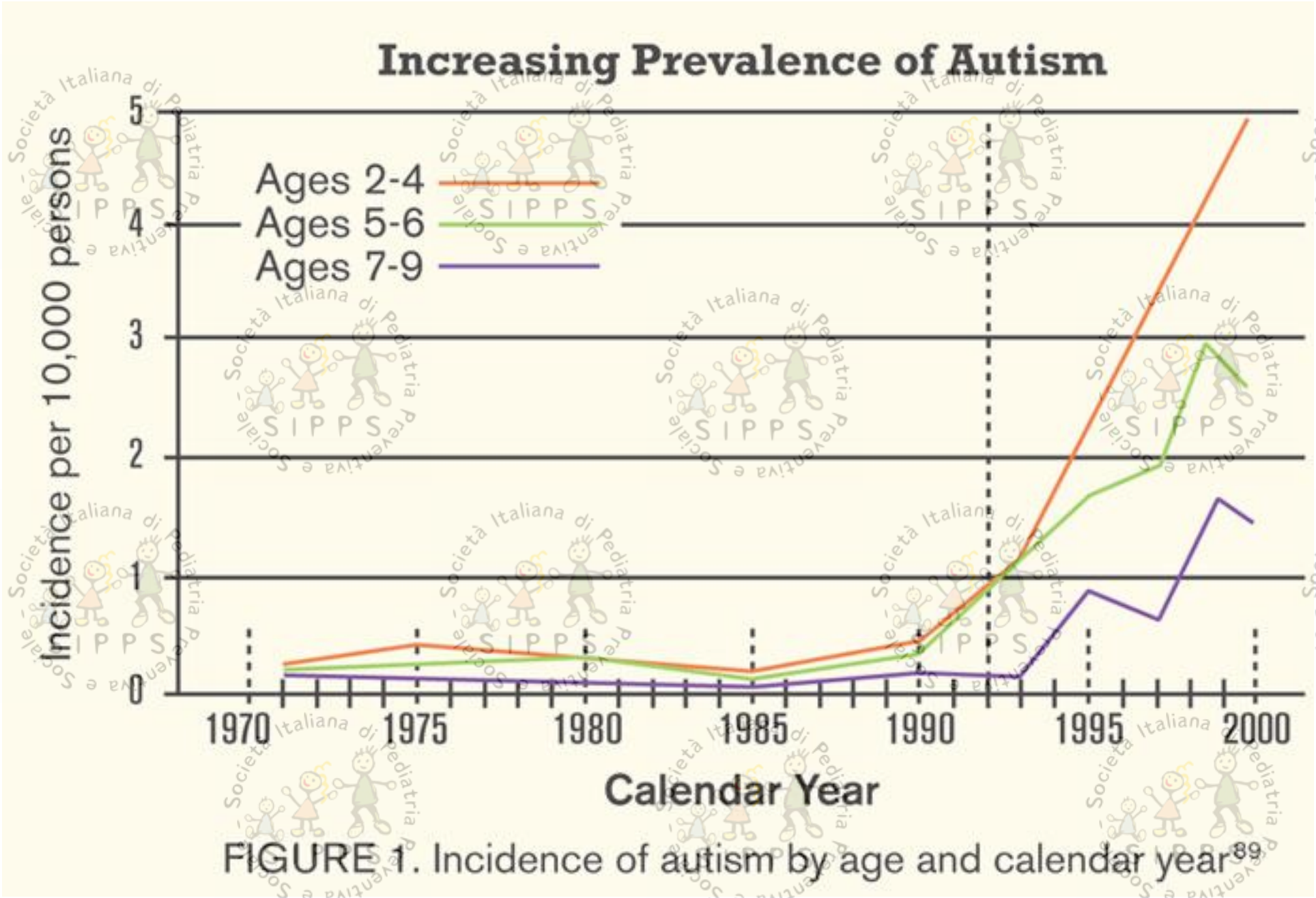


FIGURE 1. Incidence of autism by age and calendar year[89]

HARVARD SCHOOL OF PUBLIC HEALTH | [Home] [Calendar] [Directory] [Search]

Grandjean P.

A Silent Pandemic

Industrial Chemicals Are Impairing The Brain Development of Children Worldwide

For immediate release: Tuesday, November 7, 2006

Landrigan Ph

THE LANCET
Volume 368, Issue 9553, 16 December 2006-22 December 2006, Pages 2167-2178

Developmental neurotoxicity of industrial chemicals

P Grandjean, * PJ Landrigan **

Neurodevelopmental disorders such as autism, attention deficit disorder, mental retardation, and cerebral palsy are common, costly, and can cause lifelong disability. Their causes are mostly unknown. A few industrial chemicals (eg, lead, methylmercury, polychlorinated biphenyls [PCBs], arsenic, and toluene) are recognised causes of neurodevelopmental disorders and subclinical brain dysfunction. Exposure to these chemicals during early fetal development can cause brain injury at doses much lower than those affecting adult brain function. Recognition of these risks has led to evidence-based programmes of prevention, such as elimination of lead additives in petrol. Although these prevention campaigns are highly successful, most were initiated only after substantial delays. Another 200 chemicals are known to cause clinical neurotoxic effects in adults. Despite an absence of systematic testing, many additional chemicals have been shown to be neurotoxic in laboratory models. The toxic effects of such chemicals in the developing human brain are not known and they are not regulated to protect children. The two main impediments to prevention of neurodevelopmental deficits of chemical origin are the great gaps in testing chemicals for developmental neurotoxicity and the high level of proof required for regulation. New, precautionary approaches that recognise the unique vulnerability of the developing brain are needed for testing and control of chemicals.

A few industrial chemicals (eg, **lead, methylmercury, polychlorinated biphenyls [PCBs], arsenic**, and **toluene**) are recognised causes of neurodevelopmental disorders and subclinical brain dysfunction.

…

Seven years ago two well known experts in Environmental Health, a pediatrician and an epidemiologist, launched an alarm from the pages of *the Lancet*, saying that a *silent pandemic* of ADHD, autism and other neurodevelopmental disorders was spreading also due to the *shortage of funds in this area of research*

The Lancet Neurology, Volume 13, Issue 3 , Pages 330 - 338, **March 2014**

Neurobehavioural effects of developmental toxicity

Philippe Grandjean, Philip J Landrigan

Lancet Neurol 2014; 13: 330–38
Published Online February 15, 2014
http://dx.doi.org/10.1016/S1474-4422(13)70278-3

Department of Environmental Medicine, University of Southern Denmark, Odense, Denmark (P Grandjean MD); Department of Environmental Health, Harvard School of Public Health, Boston, MA, USA (P Grandjean); and Icahn School of Medicine at Mount Sinai, New York, NY, USA (P J Landrigan MD)

Correspondence to:
Dr Philippe Grandjean, Environmental and Occupational Medicine and Epidemiology, Harvard School of Public Health, 401 Park Drive L-110, Boston, MA 02215, USA
pgrand@hsph.harvard.edu

Neurodevelopmental disabilities, including autism, attention-deficit hyperactivity disorder, dyslexia, and other cognitive impairments, affect millions of children worldwide, and some diagnoses seem to be increasing in frequency. Industrial chemicals that injure the developing brain are among the known causes for this rise in prevalence. In 2006, we did a systematic review and identified five industrial chemicals as developmental neurotoxicants: lead, methylmercury, polychlorinated biphenyls, arsenic, and toluene. Since 2006, epidemiological studies have documented six additional developmental neurotoxicants—manganese, fluoride, chlorpyrifos, dichlorodiphenyltrichloroethane, tetrachloroethylene, and the polybrominated diphenyl ethers. We postulate that even more neurotoxicants remain undiscovered. To control the pandemic of developmental neurotoxicity, we propose a global prevention strategy. Untested chemicals should not be presumed to be safe to brain development, and chemicals in existing use and all new chemicals must therefore be tested for developmental neurotoxicity. To coordinate these efforts and to accelerate translation of science into prevention, we propose the urgent formation of a new international clearinghouse.

Since 2006, epidemiological studies have documented **six additional developmental neurotoxicants — manganese, fluoride, chlorpyrifos, tetrachloroethylene, dichlorodiphenyltrichloroethane,, and the polybrominated diphenyl ethers.**
We postulate that even more neurotoxicants remain undiscovered

Il rischio di ammalarsi di tumore

The risk of developing cancer

RISCHIO CUMULATIVO
OGNI QUANTE PERSONE UNA È DESTINATA AD AMMALARSI O MORIRE DI CANCRO?

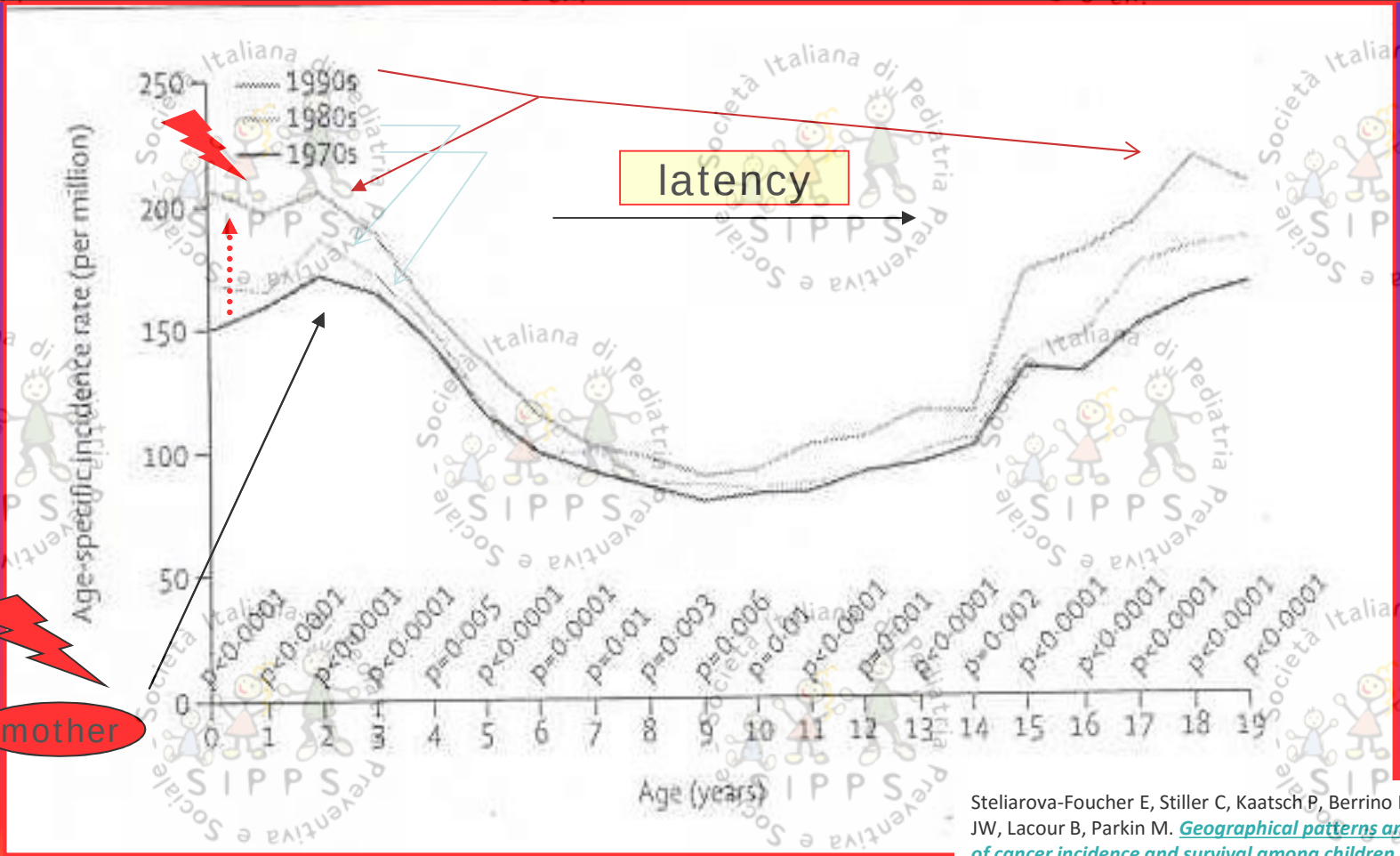
	UOMINI		DONNE	
	INCIDENZA	MORTALITÀ	INCIDENZA	MORTALITÀ
Totale (escluso epiteliomi della cute)	2	3	2	6
Prostata	7	33		
Mammella	614		8	33
Cute non melanomi	8		14	
Polmone	9	10	40	48
Colon Retto	11	26	17	46
Vescica	20	55	122	336
Stomaco	26	38	53	81

Complessivamente, in media,
1 uomo su 2 e 1 donna su 2 saranno colpiti da tumore nel corso della vita
1 uomo su 3 e 1 donna su 6 ne moriranno

A first draft of the report, published on ***the Lancet*** in **2004**, demonstrated an **annual increase of 1-1,5% for all cancers** (with more marked increases in **lymphomas, soft tissue sarcomas, tumours of the nervous system…**) . But the **most troubling was the increase - almost the double** - for all cancers **in the very first year of life (apparently due to transplacental or even trans-generational exposure)**

CA incidence in childhood and adolescence IN EUROPE (1970-1999)

http://www-dep.iarc.fr/accis.htm



Steliarova-Foucher E, Stiller C, Kaatsch P, Berrino F, Coebergh JW, Lacour B, Parkin M. ***Geographical patterns and time trends of cancer incidence and survival among children and adolescents in Europe since the 1970s (the ACCISproject): an epidemiological study.*** Lancet. 2004 Dec 11-17;364(9451):2097-105

Early Human Development (2005) 81, 123–129

ELSEVIER

Early Human Development

e/earlhumdev

(5) Pro-leukemic translocations in foetuses

In utero origins of childhood leukaemia

Mel Greaves*

Abstract Chimaeric fusion genes derived by chromosome translocation are common molecular abnormalities in paediatric leukaemia and provide unique markers for the malignant clone. They have been especially informative in studies with twins concordant for leukaemia and in retrospective scrutiny of archived neonatal blood spots. These data have indicated that, in paediatric leukaemia, the majority of chromosome translocations arise in utero during foetal haemopoiesis. Chromosomal translocations and preleukaemic clones arise at a substantially higher frequency (~100×) before birth than the cumulative incidence or risk of disease, reflecting the requirement for complementary and secondary genetic events that occur postnatally. A consequence of the latter is a very variable and occasionally protracted postnatal latency of disease (1–15 years). These natural histories provide an important framework for consideration of key aetiological events in paediatric leukaemia.

1

.. the first unambiguous evidence for a **prenatal origin of leukaemia** was derived **from studies in identical twins with leukaemia**. A case of **identical (monozygotic) infant twins with leukaemia was recorded in 1882,** and, since that time, more than 70 pairs have been published albeit in variable detail ...

2

The **concordance** rate of leukaemia varies according to subtype and age.
For infants with ALL, the rate is exceedingly high (> 50%), for "COMMON" child-ALL, is ~10%.

3

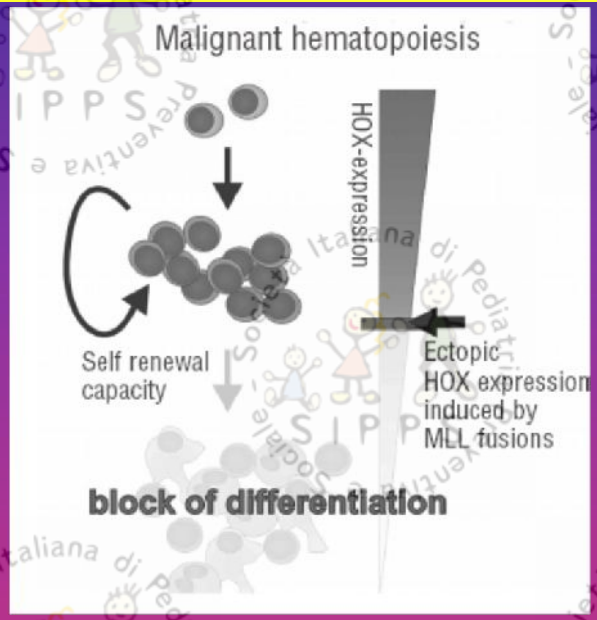
Adult leukaemia (ALL/ AML), in contrast, has a **very low rate of concordance (< 1%).**

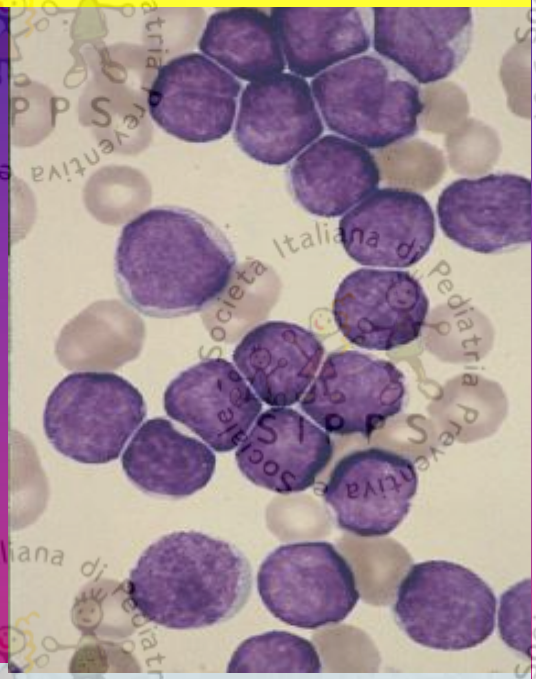
Chromosomal translocations and preleukaemic clones arise at a substantially higher frequency (~100 X) before birth than the cumulative incidence or risk of disease, reflecting the requirement for complementary and **secondary genetic events** that occur postnatally. A consequence of the latter is a very variable and occasionally protracted **postnatal latency** of disease (1—15 years).

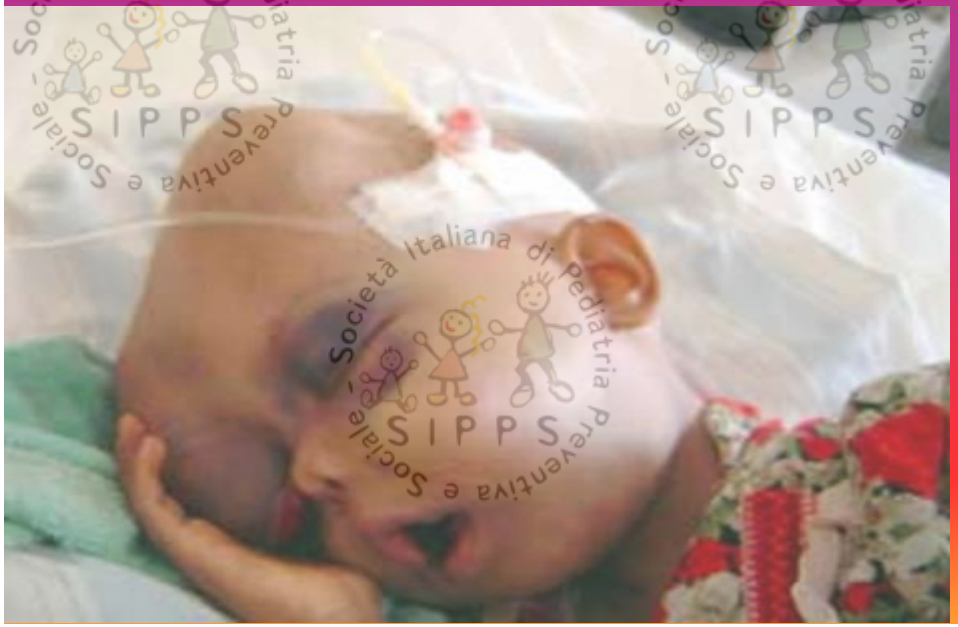
~1% of newborns had TEL-AML1 positive B lineage clones...
which represents **100 times** the incidence of **TEL-AML1 positive ALL (~1 in 12,000).**

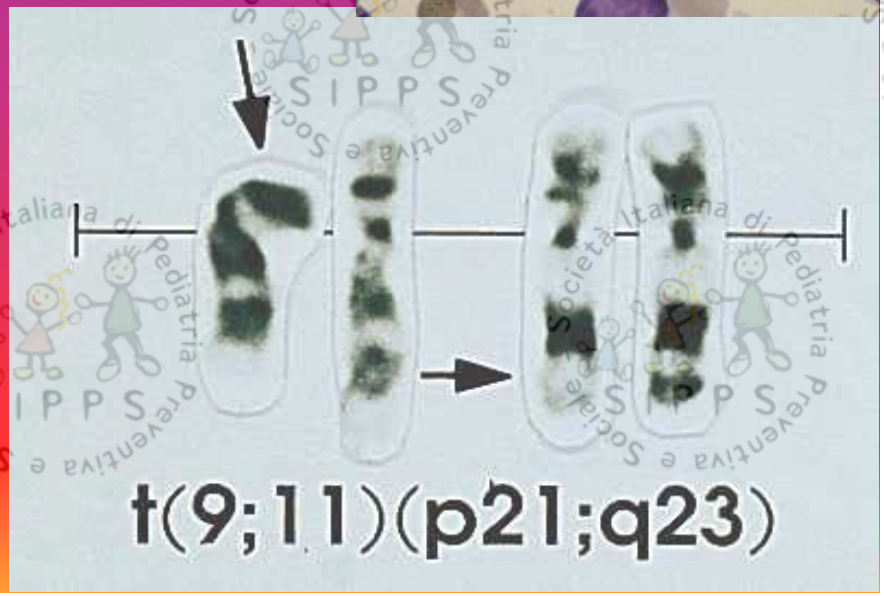
Translocations typical of myeloid leukaemia, probably due to maternal exposure to some toxic compound, were shown to be **present at birth in children who developed the disease years later** (while not sufficient per se to cause the disease, they might increase the risk for leukaemia by inducing genomic instability) Tomatis L. ***Identification of carcinogenic agents and primary prevention of cancer.*** Ann N Y Acad Sci. 2006 Sep;1076:1-14

Translocation **involving band 11q23 in AML** may occur as a result of a **deletion or trans-locations** with a number of other chromosomes and is usually associatedwith **M4** or **M5** and a poor prognosis

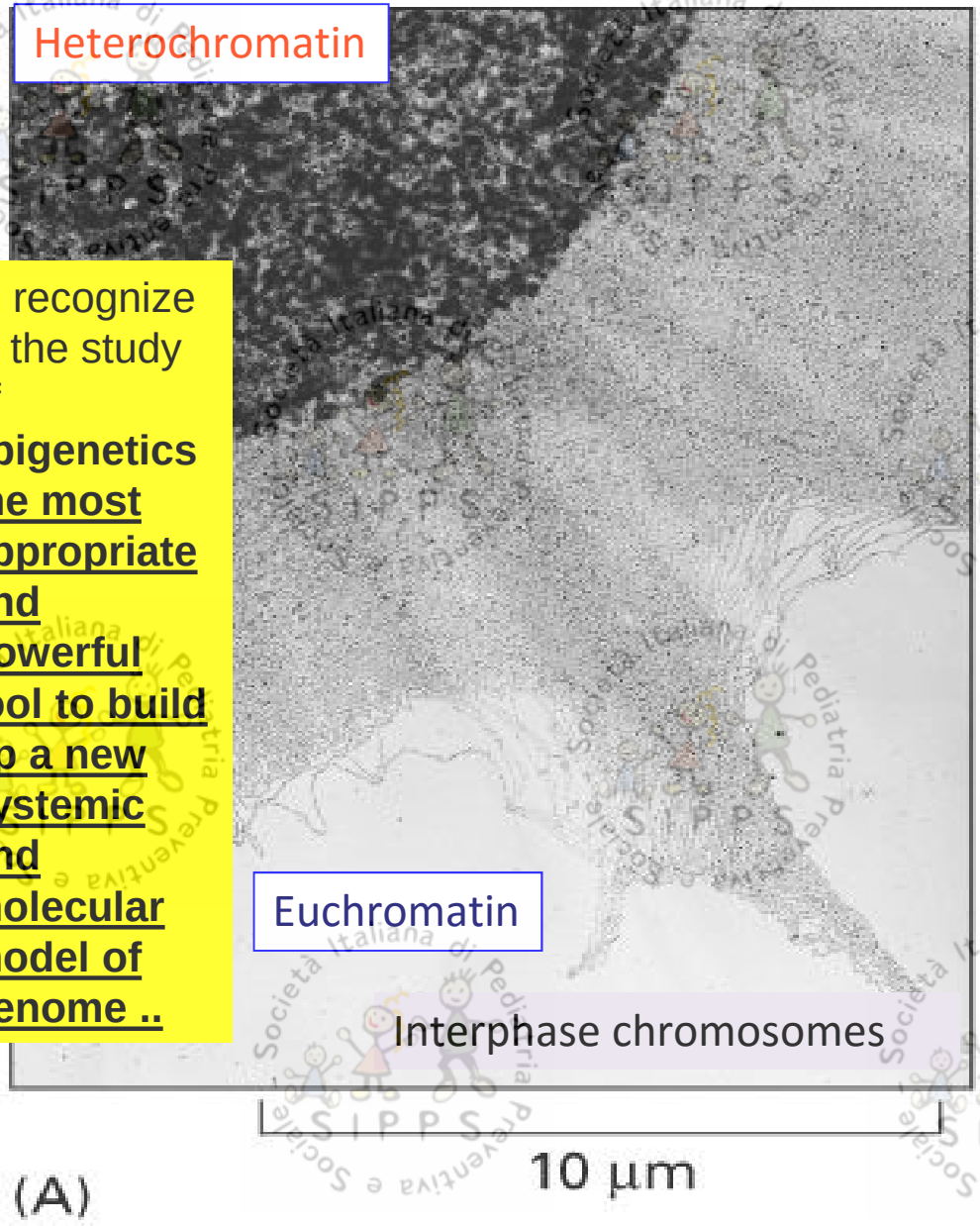




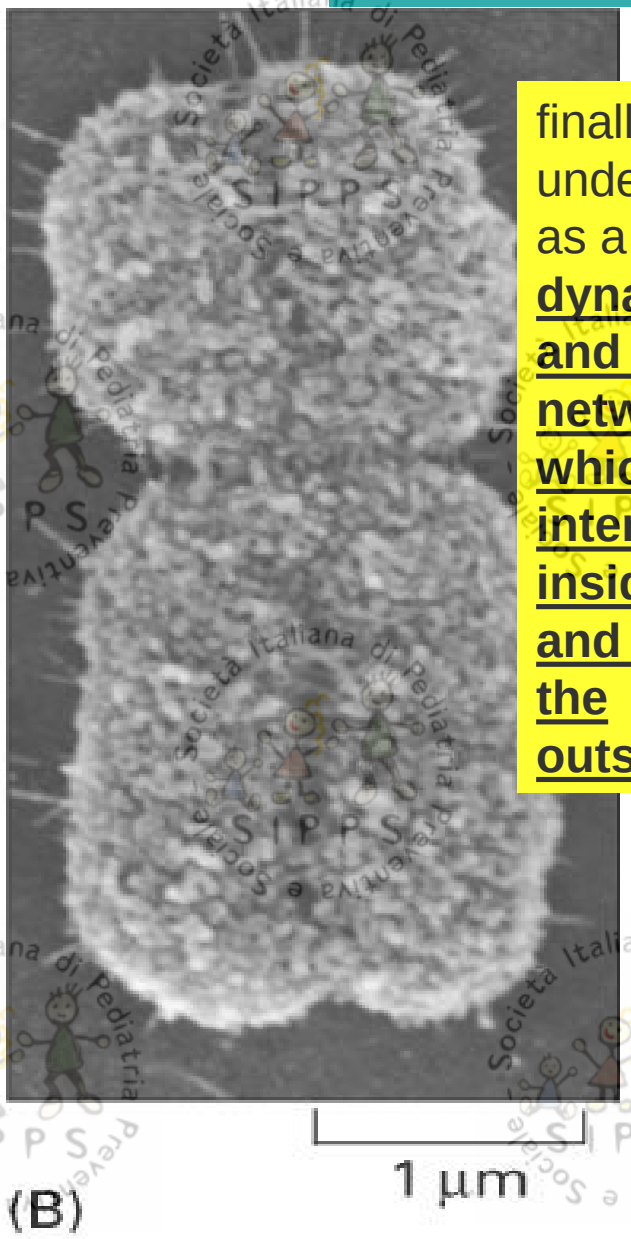




The first keyword: **Epigenetics**



to recognize in the study of **epigenetics** **the most appropriate and powerful tool to build up a new systemic and molecular model of genome ..**



finally understood as a **dynamic and fluid network which can interact inside itself and with the outside**

Figure 4–21. Molecular Biology of the Cell, 4th Edition.

nature biotechnology

COMMENTARY

Le **Dogme Central de Crick**: *Une fois l'information a pénétré dans une protéine ne peut pas sortir à nouveau* (***one direction-linear flow of information***)

EPIGENESIS AND COMPLEXITY

The coming Kuhnian revolution in biology

Richard C. Strohman

The Watson-Crick era, which began as a narrowly defined and proper theory and paradigm of the gene, has mistakenly evolved into a revived and thoroughly molecular form of genetic determinism.

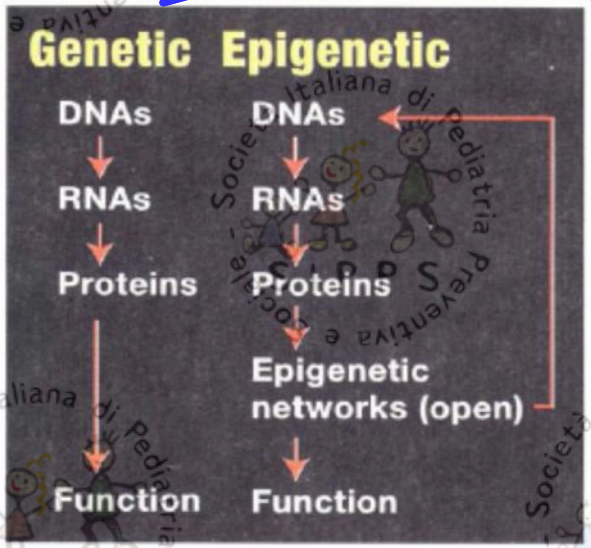


Figure 1. Genetic and epigenetic theories of information processing.

Pour citer le biologiste moléculaire Richard C. Strohmann : l'ère de **Watson et Crick**, qui a commencé comme une **théorie du gène a évolué à tort dans une théorie et le paradigme de la vie**: c'est a dire, dans une **forme revivifiée et soigneusement moléculaire du déterminisme génétique**

Science

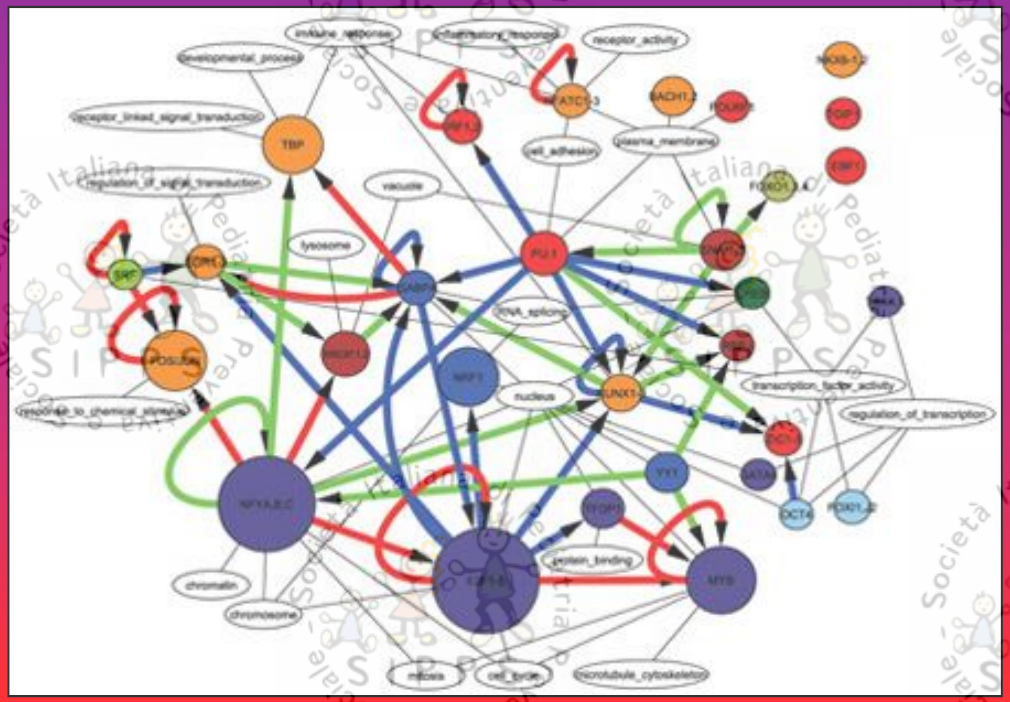
AAAS

ScienceInsider

Breaking news and analysis from the world of science policy

From directing **the fate of stem cells to determining how.. we grow**, **the genes in our body act in complex networks..** the whole ***Genome*** is a Complex and **highly dynamic molecular Network** of ***interacting Genes*** and ***non-codifying sequences.***. and ***proteins***

....Genes Know How to Network…BUT…



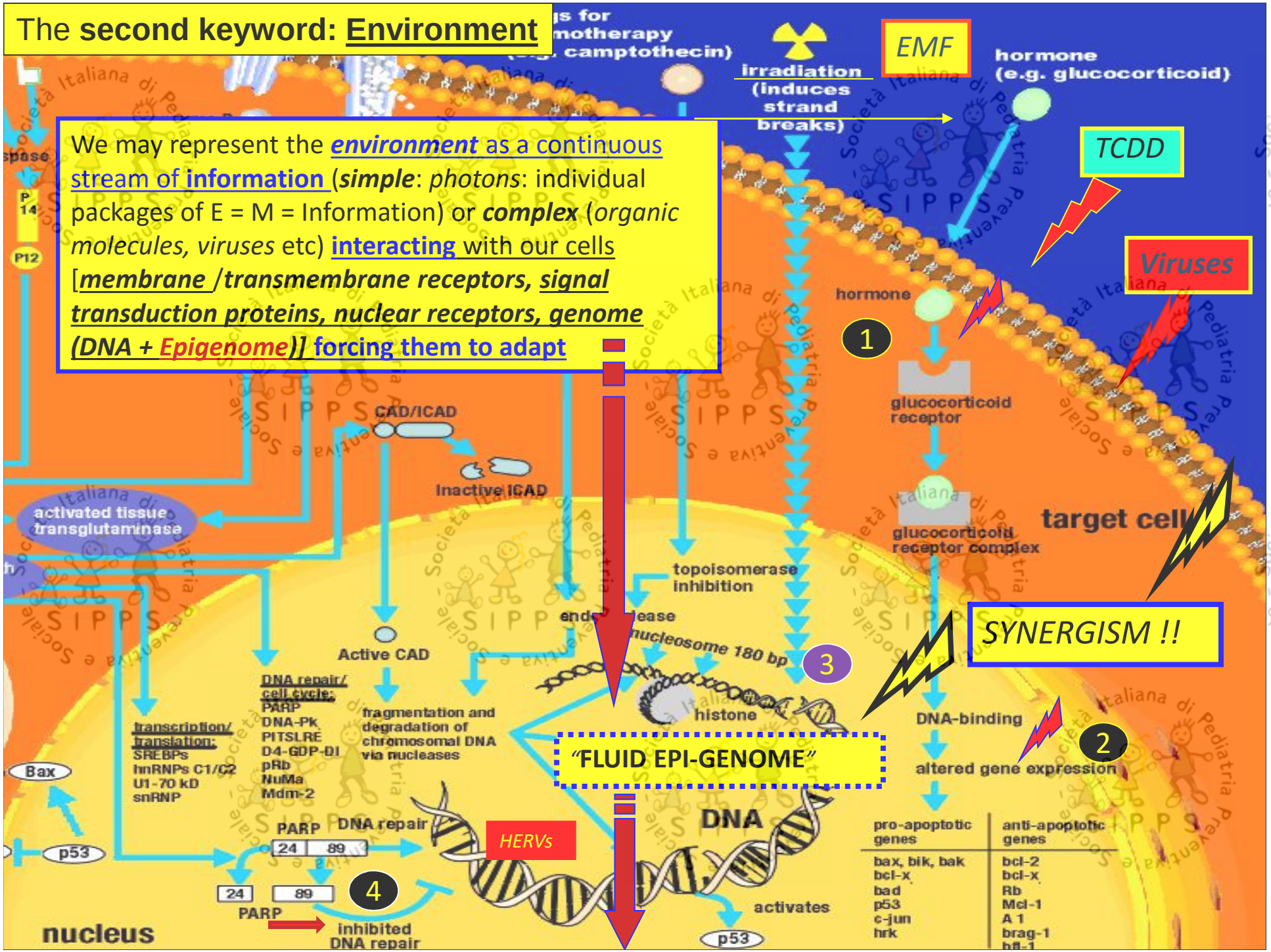
IN FACT Genes need to be told to switch "off" and "on":

- **Genes need to be told** how much **expression (protein) is required** and where.
- **Genes need to be regulated** – this **regulation is not performed by DNA** but by many other controls arranged in a **complex network**
- DNA has been called the *Book of Life* by the *Human Genome Project* scientists, but many other biologists consider **DNA to be simply a random collection of words from which a meaningful story of life may be assembled…**
- **In order to assemble that meaningful story, a living cell uses a second informational system. (...) The key concept here is that these dynamic-epigenetic networks have a life of their own —they follow network-rules not specified by DNA**

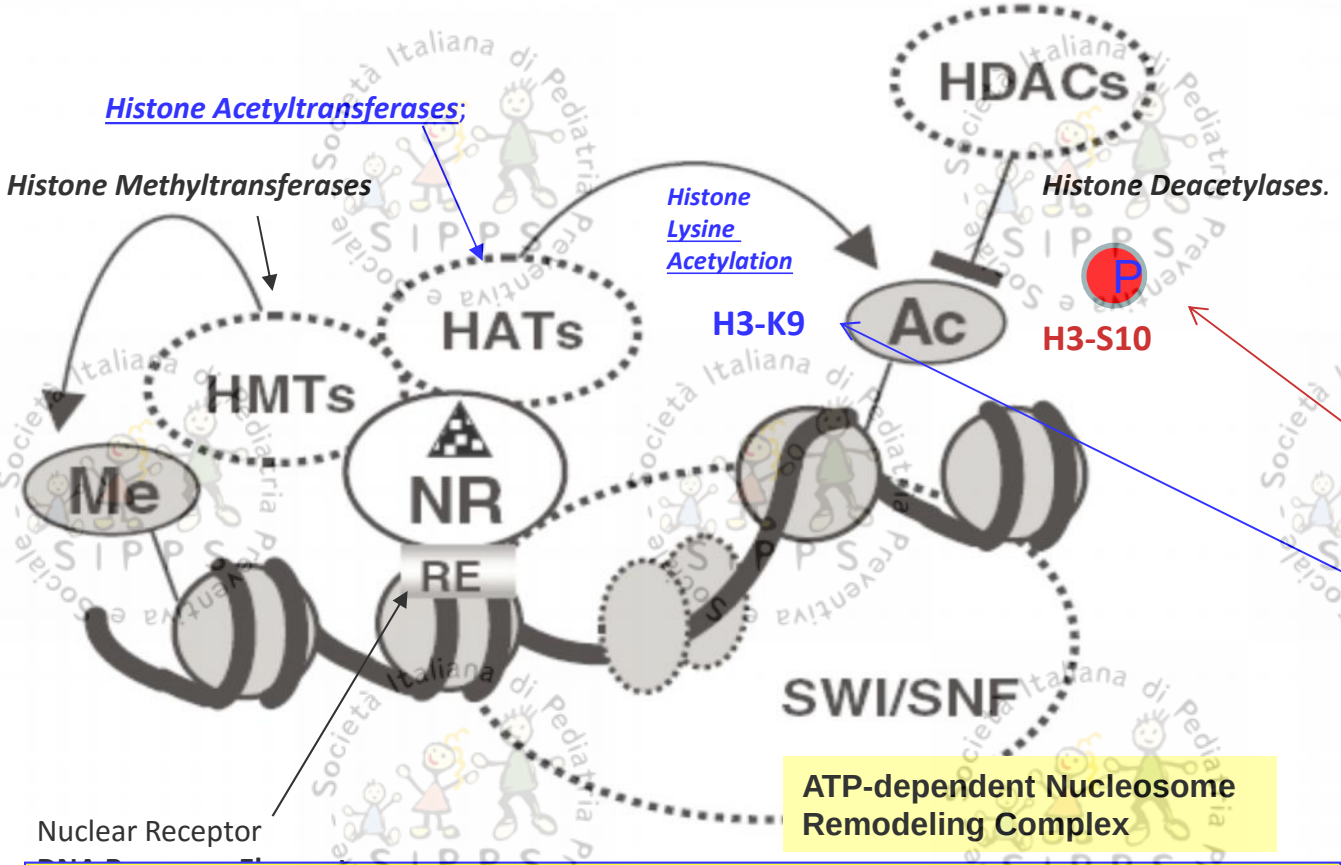
http://news.sciencemag.org/sciencenow/2009/04/21-03.html

Strohman R. , April 2001 Beyond genetic determinism

The **second keyword: Environment**



The "***meeting-point***" between the **information** coming from the **environment** and the information encoded in the **DNA** (***hardware***) is the ***epigenome (software)***: ***mimetic molecules (EDCs)*** and other ***pollutants*** or ***danger-signals*** **induce the epigenome to change**



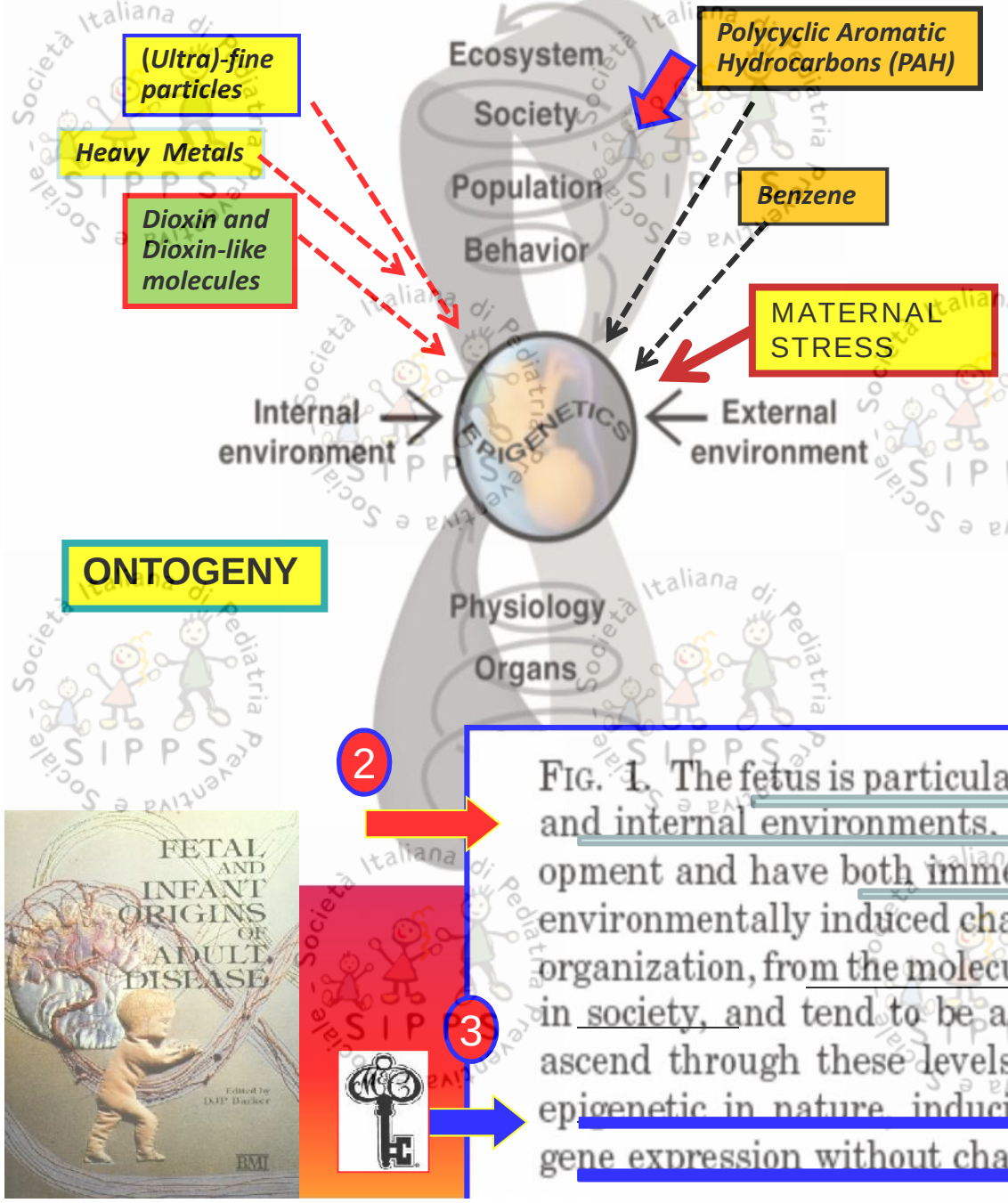
Many toxicants cause rapid alterations in gene expression by **activating protein kinase signaling cascades**.

The resulting **rapid, defensive alterations in gene activity require the transmission of a signal directly to the histones** present in the **chromatin of stress response genes**:

within minutes of exposure the **phosphorylation of serine 10 of histone H3** and the **acetylation of lysines 9 and/or 14** take place

Chromatin itself is the direct target of many toxicants *
… toxicant-induced perturbations in chromatin structure may precipitate adverse effects.. Forcing genome to change

The third key word is ***fetal programming***



this is **not a generic concept, concerning the way in which the "genetic program" contained in DNA is translated, during the nine months of the ontogenetic process, in a specific complex phenotype**.

1

on the contrary,this is a **precise technical term that refers to the ability, and at the same time to the necessity, of embryo-fetal cells to define their epigenetic setting in adaptive (and predictive) response to the information** coming from the mother and, through her, from the outer world.

2

3

FIG. 1. The fetus is particularly vulnerable to changes in the external and internal environments, which interact to influence fetal development and have both immediate and life-long consequences. Such environmentally induced changes can occur at all levels of biological organization, from the molecular to the organism's behavior and place in society, and tend to be amplified in their consequences as they ascend through these levels. Ultimately, these influences may be epigenetic in nature, inducing mitotically heritable alterations in gene expression without changing the DNA.

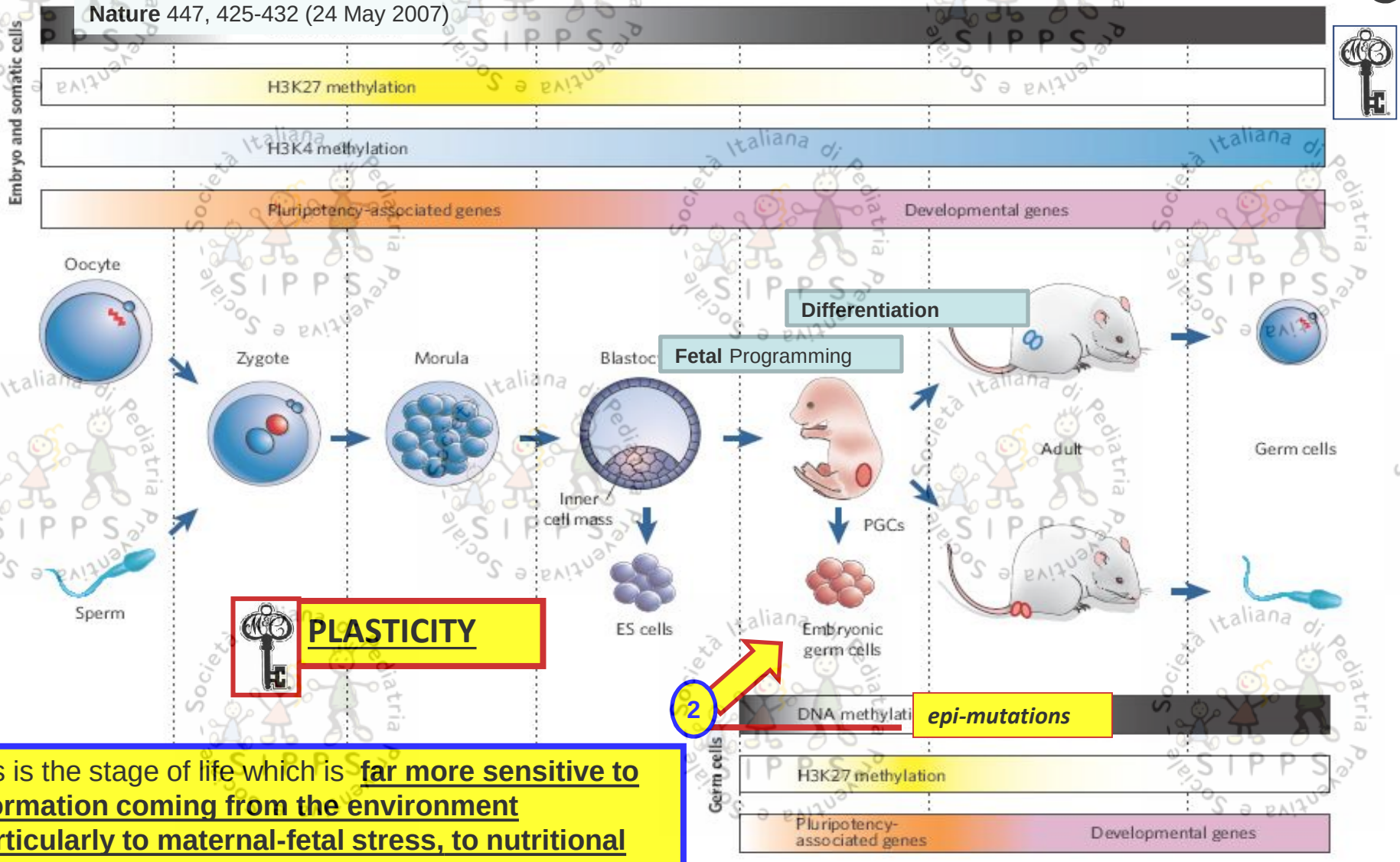
The **fourth** keyword is ***developmental plasticity***

The actual genetic program of a particular individual is actually the product of nine months of epigenetic adaptive-predictive "formatting" of billions of cells)..

1

Stability and flexibility of epigenetic gene regulation in mammalian development

Nature 447, 425-432 (24 May 2007)



This is the stage of life which is **far more sensitive to information coming from the environment (particularly to maternal-fetal stress, to nutritional errors, to pollutants ..)**

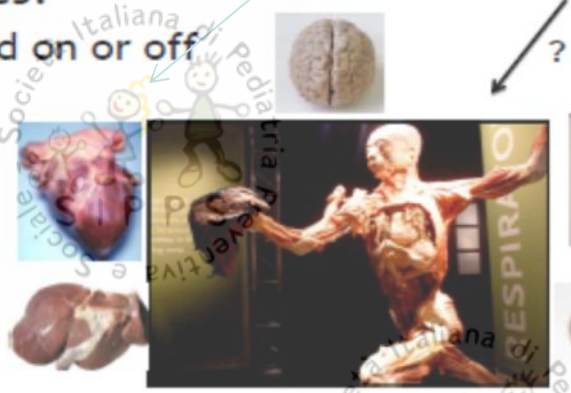
methylation. During the early development of PGCs, DNA methylation and

Same DNA, Different Look

- We are made up of over 200 cell types.
- Each cell has the same DNA!
- How can they look so different?

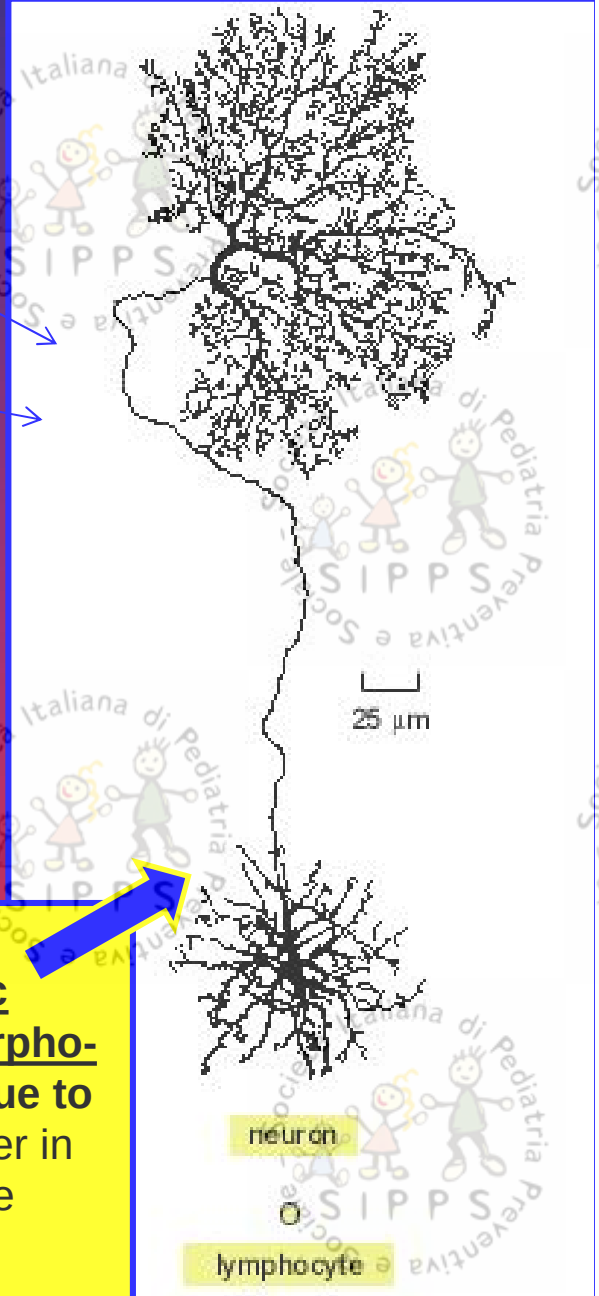
Epigenetics!

- Genes turned on or off



Wikimedia Commons, ORNL.gov, Flickr: richdelux

HARVARD MEDICAL SCHOOL



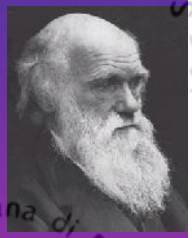
This image clearly shows the **"power" of the epigenome** and the **predominant role of environmental information in the phenotypic shaping of cells, tissues , organisms** .. the **huge phenotypic (morpho-functional) difference** between a *lymphocyte* and a *neuron* **is not due to DNA, which is virtually identical in the two cells** , but to the manner in which **the same genome has been utilized by the two cells**, on the basis of the **information (positional and environmental) received during the first months of life (for neuron in the first 2 years)** and **processed by the epigenetic networks**

The **fifth** key word is **phylogeny**

The chimpanzee DNA is for 98.77% identical to the human .
On average, a gene encoding a protein in a man differs from its chimpanzee ortholog by only two aa substitutions
.. almost one third of human genes
has exactly the **same protein translation** as their orthologs in chimpanzee

We are quite stable (for millions of years) both genetically and phenotypically

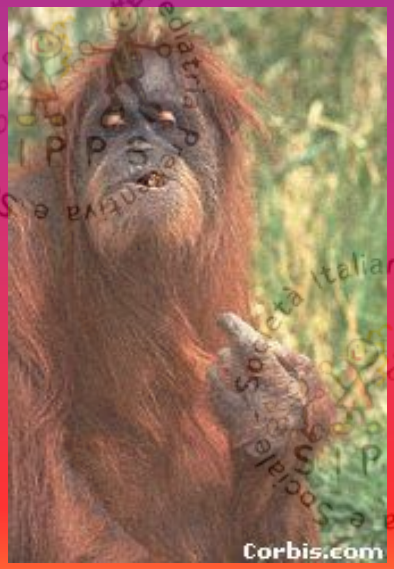
Species ***phylogeny***

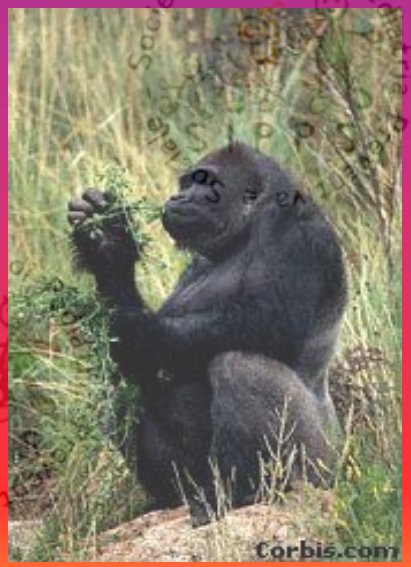


From the Tree of the Life Website, University of Arizona

Evo

Orangutan | *Gorilla* | ***Chimpanzee*** | ***Human***





Sanger Institute

Phylogenesis

of 4 billion years of molecular coevolution * (in particular, our **DNA** is the **product** of this long journey) ..

Mismatch

Ontogenesis

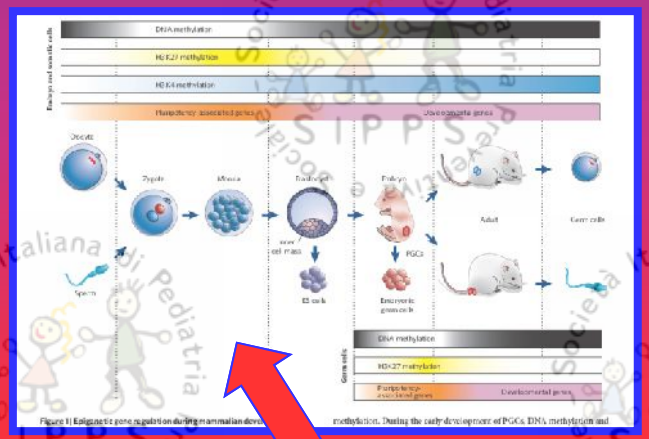
And of **9 months of an individual development**

our **epigenome** being the product of nine months of ***cellular and tissue programming*** (**adaptive** to an environment that is rapidly changing)..

We should never forget that **we are at the same time the product**

Devo-Evo

Ontogeny Recapitulates (***anticipates***) ***Phylogeny***



A ***major risk***: the **EDCs** and other ***xenobiotics*** (***not*** being the product of ***molecular coevolution***) can interfere at this level, acting as ***pseudo-morphogens***

..recently, the ***fetal programming mismatch theory*** has been transformed into the **key-moodel theory of DOHAD..**

Obesity/Metabolic Syndrome

Cardiovascular Diseases

Obesogens

DOHAD

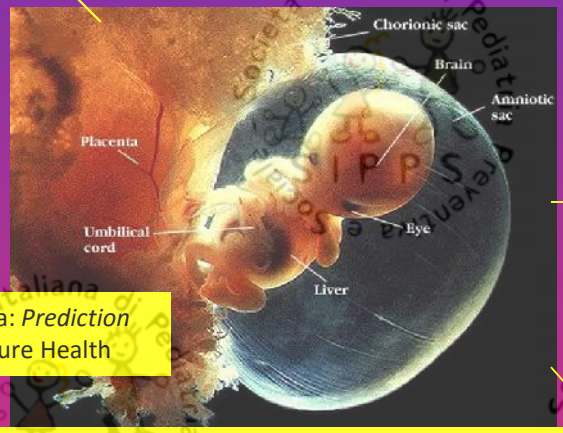
Ipertension

Multiorgan Effects of Endocrine Disruptors

Pesticides

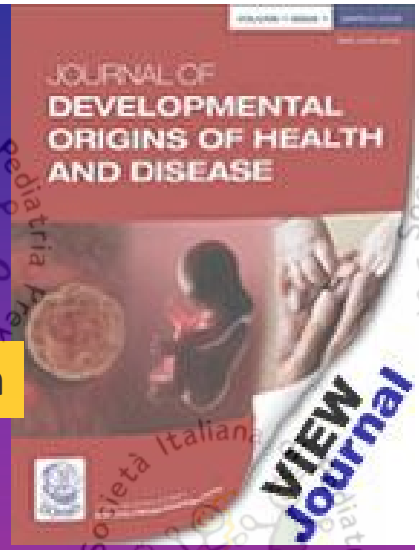
In Vitro Fertilization

Materno Fetal Stress



Placenta: *Prediction* of Future Health

Developmental Time Windows of Vulnerability



OBESITY DIABESITY PANDEMICS

Asthma and allergies

Lung Development

Reproductive Diseases/Dysfunctions

Semen Abnormalities

CANCER

Neurobehavioral Deficits and Diseases

Psychiatric Diseases

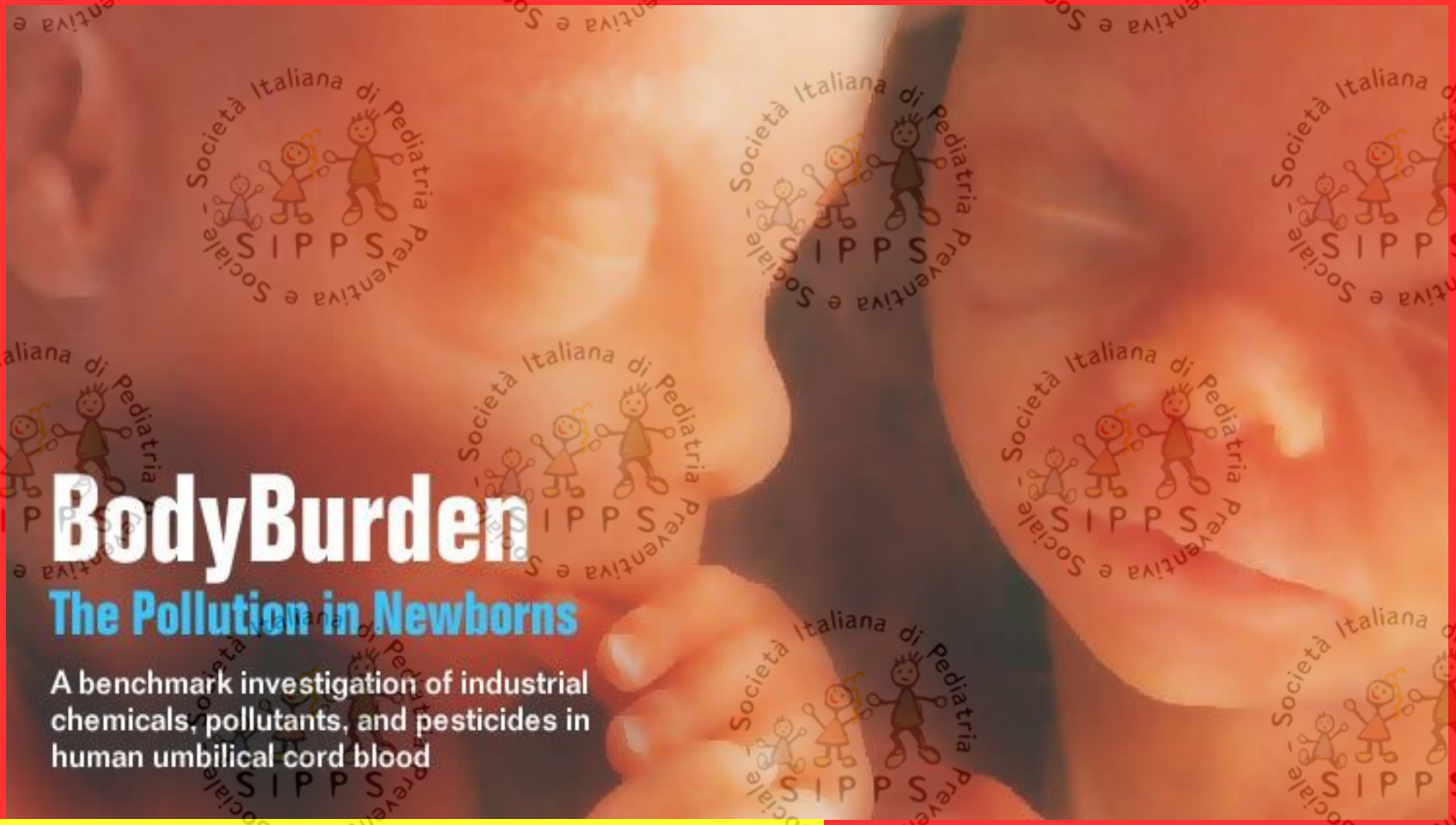
CHEMICAL FALL OUT

The gift our mothers never wanted to give us

1 **ENDOCRINE DISRUPTORS**
dioxin-like moleculles

2 **HEAVY METALS**

3 **ULTRAFINE PARTICLES**

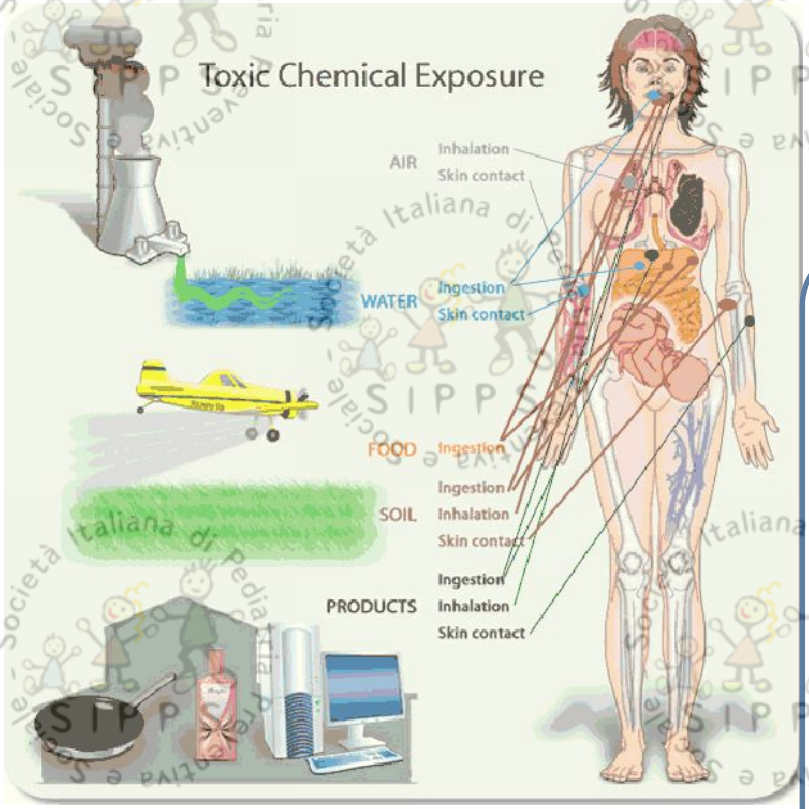


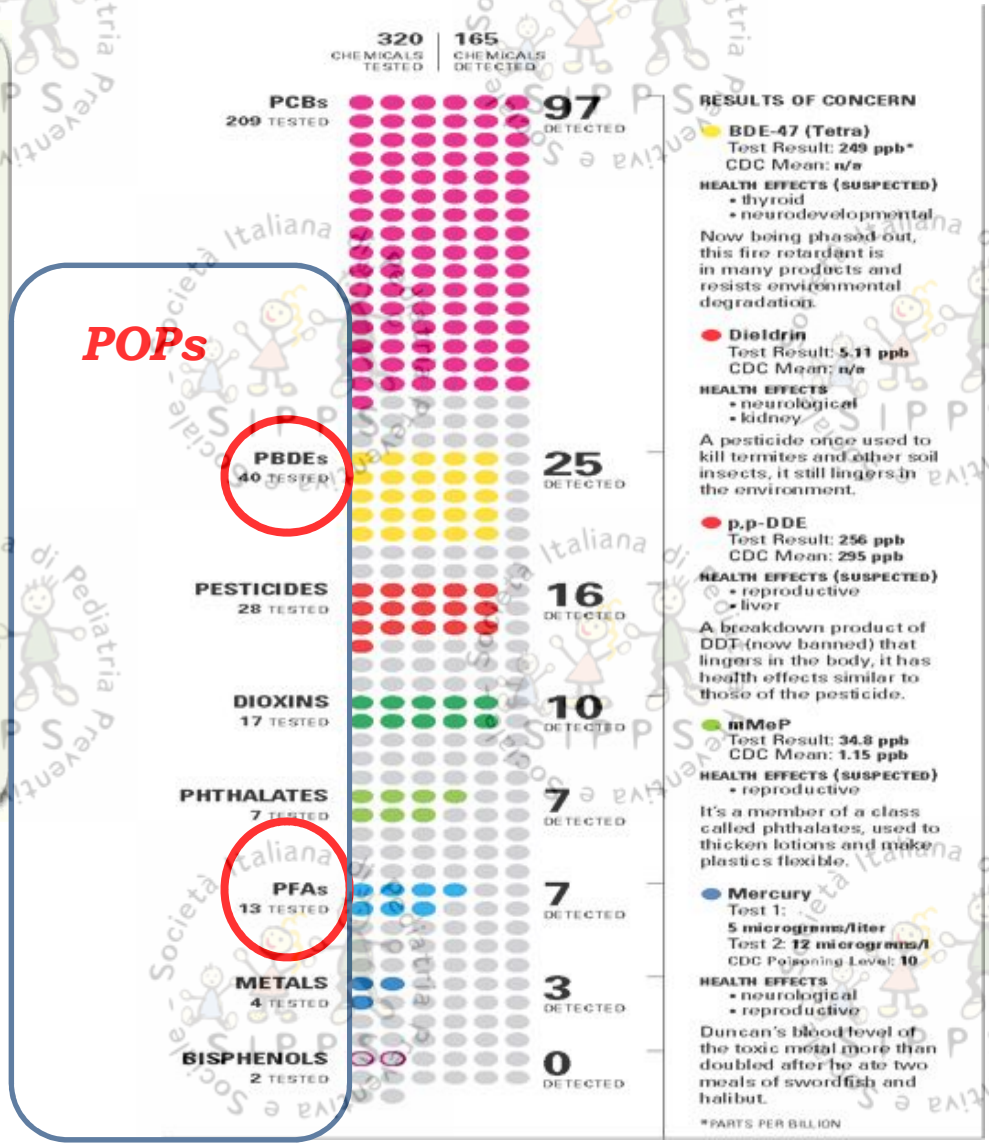
.. at present many studies in various parts of the world are evaluating the ***chemical body burden*** .. especially in women, children, embryos / fetuses, **providing dramatic results**.

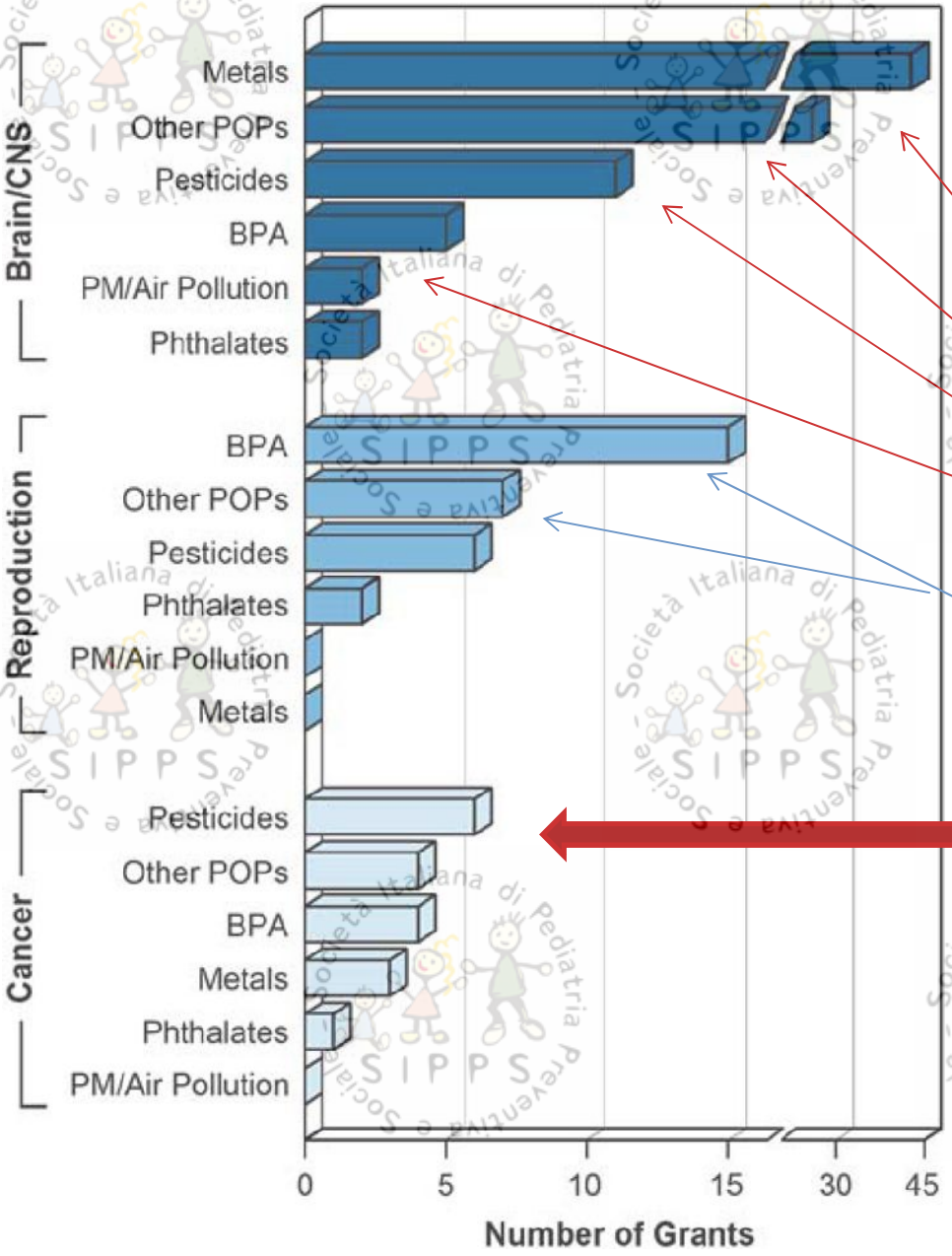
http://www.ewg.org/reports/generations/

Monitoring Body-Burdens

700 different synthetic chemicals or heavy metals found in human blood,







Most studied **disease/organ endpoints** and associated **toxicity endpoints**.

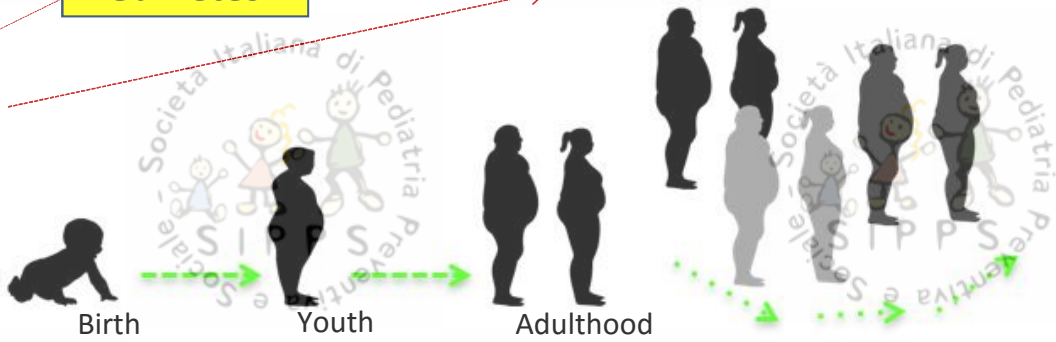
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4393755/figure/F3/

Environmentally driven epigenetic effects

Genetic makeup (mother and fetus)

Gametes

Effects across multiple generations (obesity, T2D)



Fetal plasticity* and *programming

Main fetal targets

- Hypothalamus
- Neuroendocrine system
- Adipocites
- Gametes

Prenatal environment / Early life environment

- Nutrient deficiencies/excesses
- Obesogens
- Oxidative stress

Life course

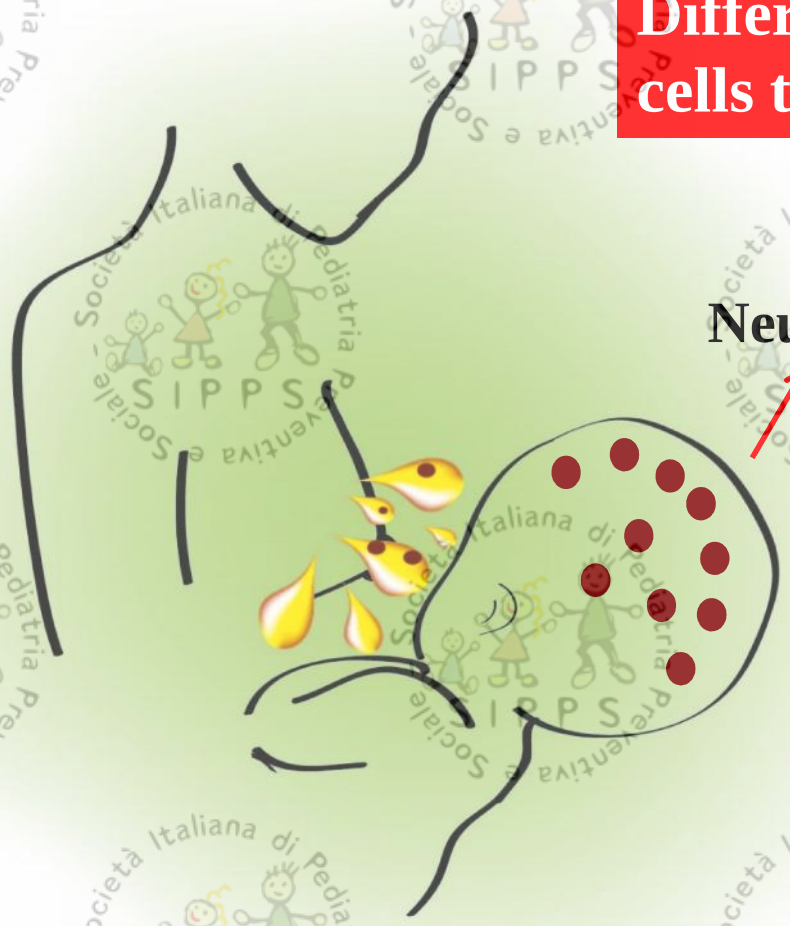
Periods of major epigenetic plasticity

OBESITY AND DIABETES: FROM GENETICS TO EPIGENETICS (Mol Rep 2015)

Ernesto Burgio[1,2], Angela Lopomo[3,4] and Lucia Migliore[3]

FROM BREAST MILK TO BRAIN

Differentiation of breast-milk stem cells to neural stem cells and neurons



Neurons

Oligodendrocytes

Astrocytes

Metabolomica liquido cellule staminali

Hosseini SM Neurol Res Int 2014

www.jpnim.com Open Access eISSN: 2281-0692
Journal of Pediatric and Neonatal Individualized Medicine 2015;4(2):e040237
doi: 10.7363/040237
Received: 2015 Sept 21; accepted: 2015 Oct 10; published online: 2015 Oct 26

Editorial

Environment and fetal programming: the origins of some current "pandemics"

Ernesto Burgio

ECERI – European Cancer and Environment Institute, Bruxelles, Belgium

ISDE – International Society of Doctors for Environment (Scientific Office), Arezzo, Italy

"The womb may be more important than the home"
David Barker

This new paradigm is important not only to explain in a more exhaustive way the embryo-foetal origins of all the above mentioned disorders and their dramatic increase over the last decades, but also to try to effectively face this epidemiological transition. The key-term in this context is certainly primary prevention: only by reducing the maternal-foetal factors of distress and the exposure of the foetus (and of its gametes) to pollutants, it would be possible to protect the correct programming of cells, tissues and organs.

The key-term in this context is certainly ***primary prevention***

Gestation | Birth | Brain Development

Infancy | Childhood | Adulthood

R01 MH-091351, R01 HD-06028, R01 HD-065825

- Baseline Blood/ Hair Sample
- Fasting Blood sample
- Psychosocial Stress Assessment
- Neuropsychological Battery
- Fetal Ultrasound
- Cervicovaginal Swabs
- Anthropometric Measures
- 4 Day Ambulatory Period:
  - Diurnal Salivary Cortisol (7 per day)
  - Actiheart Device
  - Electronic Diary (Smart Phone)
  - 2 Random Dietary Recall Assessments
  - 24 hr Urine

- Neonatal Brain MRI (structural MRI, DTI, resting state fMRI)
- Neonatal Motor Performance (TIMP)

- Infant Cognitive, Motor & Emotional Behavior (Bayley's)
- Infant Home Environment
- Mother/Infant Interactions
- Infant Stress Reactivity

- Infant Brain MRI (structural MRI, DTI, resting state fMRI)
- Infant Cognitive, Motor & Emotional Behavior (Bayley's)
- Mother/Infant Interactions

The key-term in this context is certainly ***primary prevention*** the role of ***pediatricians, neonatologists, gynecologists*** will be **strategic** in the coming years

THE UNIVERSITY OF CALIFORNIA IRVINE DEVELOPMENT, HEALTH AND DISEASE RESEARCH PROGRAM

A **new scientific truth** does not triumph by **convincing its opponents** and making them see the light,
<u>but rather because its opponents eventually die, and a new generation grows up</u> that is familiar with it.

Max Planck (1858 - 1947)