

# change

## Birthing & Parenting at Times of Crisis



20 experts  
in Prenatal  
Psychology,  
Medicine &  
Health!

Editors: Olga Gouni, Jon RG Turner, Troya GN Turner

*Honorary Copy  
With Our Compliments*

## Challenging Times

In times you feel outmatched  
It's best to stay unattached  
Learn to thrive and sacrifice  
Be courageous and aim high.  
No matter how long it will take  
Your spirit will not break.  
Be creative, find your passion,  
Become the architect of the tomorrow!

*Brigitte Winkler*

Title  
Change:  
Birthing and Parenting at Times of Crisis

ISBN: 9798705980154



Cover: Window to the Womb  
by Antonella Sansone, (*see chapter 9*)

*The painting draws on Leonardo Da Vinci's drawing and quote about the intrinsic relationship between a mother and her unborn child four centuries ago, "The same soul governs the two bodies... the things desired by the mother are often found impressed on the child which the mother carries at the time of the desire... one will, one supreme desire, one fear that a mother has, or mental pain has more power over the child than over the mother, since frequently the child loses its life thereby. (Leonardo Da Vinci, Quaderni).*

Editors:  
Olga Gouni  
Jon RG Turner  
Troya GN Turner-Groot

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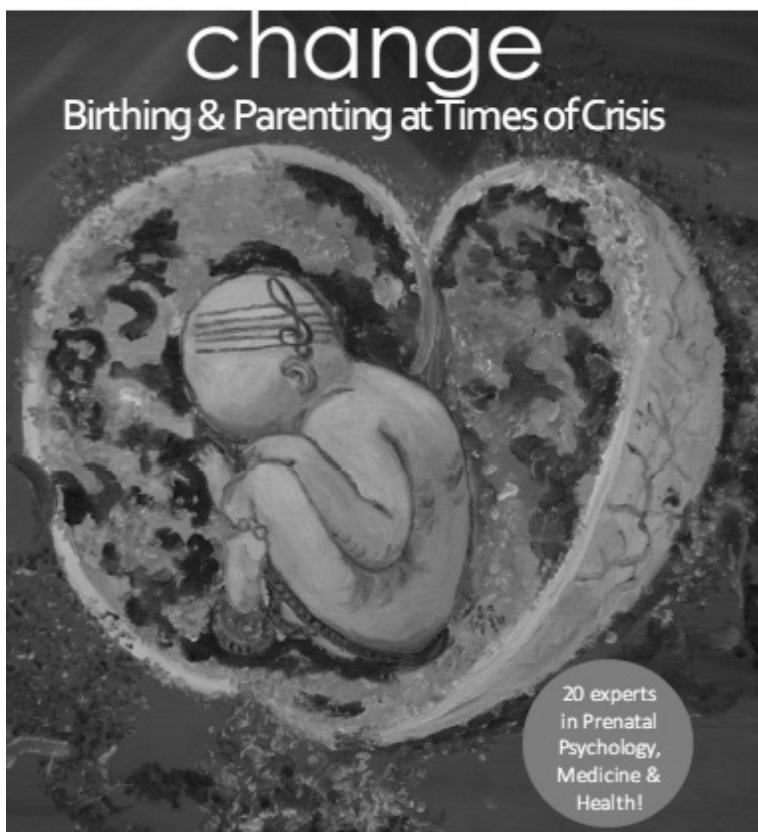
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**cosmoanelixis**  
PRENATAL & LIFE SCIENCES

Athens, Greece, <https://www.cosmoanelixis.gr>, info: [info@cosmoanelixis.gr](mailto:info@cosmoanelixis.gr)



Editors: Olga Gouni, Jon RG Turner, Troya GN Turner

ATHENS, 2021

“Life is a series of  
natural and spontaneous changes.  
Don’t resist them;  
that only creates sorrow.  
Let reality be reality.  
Let things flow naturally forward  
in whatever way they like.”

*Lao Tzu*

**“** This Book on Change has the potential to change your life!

It brings together the experiences, thoughts & inspirations of leading “life” minds in the fields of Prenatal Psychology, Medicine and Health.

By sharing their discoveries regarding the dynamics of critical Change, especially when it comes as an adversity or crisis, they exemplify one of the most natural of nature’s phenomenon for all human beings – Change!

Actually, Change is another word for Life!

Life is based on the continuation of Change!

Life cannot exist without Change for every living expression from microbes, plants, animals all the way up the ladder life of the human being.

Change can be expressed through our human physical, mental, emotional and/or spiritual awarenesses.

Change is expressed through our desire to live, to grow & evolve; our interests in life; our relationship with the environment; our accomplishments; our expertise; our delight!

Change happens most creatively through New Life, crowning in the evolution of all humanity!

This book brings various faces of Evolutionary Change to all readers open to more understanding about changing human life, vibrantly alive! **”**

**Troya GN Turner**

*Co-Editor,*

*Co-Founder & Co-Director Whole-Self Discovery & Development  
Institute International, Inc. Grootebroek, The Netherlands*

“Here's to the crazy ones.  
The misfits. The rebels.  
The troublemakers.  
The round pegs in the square holes.  
The ones who see things differently.  
They're not fond of rules.  
And they have no respect for the status quo.  
You can quote them, disagree with them,  
glorify or vilify them.  
About the only thing you can't do  
is ignore them.  
Because they change things.  
They push the human race forward.  
And while some may see them  
as the crazy ones,  
we see genius.  
Because the people who are crazy enough  
to think they can change the world,  
are the ones who do.”

*Rob Siltanen*

Dedicated to  
all those who dare and step  
into the unknown,  
keep their hearts open  
and honor their humane qualities.

"You can't stop the future  
You can't rewind the past  
The only way to learn the secret  
...is to press play."

*Jay Asher*



"

*The world as we have created it  
is a process of our thinking.  
It cannot be changed  
without changing our thinking."*

*Albert Einstein*

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*contents*

Acknowledgements	page	xiii
Prologue by <i>Olga Gouni</i>	page	1
Introduction by <i>Jon RG Turner</i>	page	3
CHAPTER 1		
<b>On the Paradox of the Opposites: Change and Permanence</b>		
<i>by Olga Gouni</i>	page	9
CHAPTER 2		
<b>Twentieth Century Highlights</b>		
<i>by Mirjana Sovilj, Emilija Radmilović and Olga Gouni</i>	page	25
CHAPTER 3		
<b>The Influence of Electromagnetic (EM) Radiation on Biological Systems and humans</b>		
<i>by Dejan Raković</i>	page	45
CHAPTER 4		
<b>Challenges of Parenting During Periods of Rapid Changes</b>		
<i>by Elizabetha Levin</i>	page	67
CHAPTER 5		
<b>Ethical Issues Regarding Maternal and Neonatal Health in Times of Disaster</b>		
<i>by Claire Zerafa, Raymond Zammit and Jean Calleja Agius</i>	page	123

*Birthing and Parenting at Times of Crisis*

**CHAPTER 6**

**Change through my Kaleidoscope**

*by Ankita Marjadi*

page 145

**CHAPTER 7**

**The Inheritance of Change**

*by Thomas R. Verny*

page 157

**CHAPTER 8**

**What is Left Behind? What is in the Horizon?**

**Quantum Mechanical Interpretation of Prenatal Memory**

*by Akira Ikegawa*

page 199

**CHAPTER 9**

**Cultivating a mindfulness relationship-based parenting culture at times of adversity**

*by Antonella Sansone*

page 209

**CHAPTER 10**

**When inside and outside experiences collide**

*by Helga Blazy*

page 261

**CHAPTER 11**

**The inner child or the "inner child"?**

**Confusion during pregnancy and its lifelong consequences**

*by Klaus Evertz*

page 293

**CHAPTER 12**

**Prenatal Parenting in Times of Crisis**

*by Karlton Terry*

page 315

**CHAPTER 13**

**Resilience in a time of Crisis.**

Change

**The Benefits of Birth Related Therapy**

*by Matthew Appleton*

page 335

**CHAPTER 14**

**The Importance of Prenatal Psychology Changes  
in Different Professional Fields**

*by Ludwig Janus*

page 369

**EPILOGUE**

**Our World Vision**

*by Anika Marjadi*

page 384

About the Editors and Authors

page 387

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## Acknowledgements

Over the last decades, we have been witnessing a global crisis of not only socio-economic nature but also of the environment which should sustain and nurture us, public health and human well-being. Humanity is undergoing unprecedented experience globally, which may mark unforeseen changes to the lifestyles and attitudes!

As researchers, health professionals or just thinking scholars/ people are confronted with numerous questions asking for answers. We also have had to realize the collective power of communities to create meaningful change, especially at this specific moment of the continuum which has shown very clearly that “normal” doesn’t work anymore. Communities are agents of change and the healthier they are, the healthier the attitudinal change they can create.

This book is the result of the collective energy of a beautiful community of thinkers, researchers, academicians, pioneers in the fields of prenatal psychology, medicine and health dispersed all over the globe but strongly linked together as their common values, principles and philosophies have been interwoven over the last 30 years of being and working together. This book is one more gift that was made possible because they all care about you, the reader, the mother and father of life on earth. My deepest gratitude goes to them all who are signing each chapter but also those invisible supporters behind the front liners.

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Change

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*Birthing and Parenting at Times of Crisis*  
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Thank you so much, Klaus Evertz, for your insights into human nature

Change

and your uncovering of the stories humans tell when they allow color to express. Your teachings, the free spirit behind the paint and the analytical depth of the artistic creations in all forms of Art is an eye-opener.

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Not least, I would like to take this opportunity to thank my two lifelong friends Brigitta Winkler and Marina Stefanides who have been the safe ports when life storms seemed too turbulent and who have always been there for each of us so that we can see again our evolutionary pathways in times of blindness and listen to our soul songs in times of deafness.

Finally, thank you, Kika, my new young neighbor, for your kindness and the gifts of good will you offer me every morning as you greet me with a smile. In your face, I am reminded of all good, kind anonymous people I have met over the last few months spent in a beautiful, spotlessly clean, Greek island, where this book was born. I would like to thank them all. Lockdowns, restrictions and orders of isolation cannot break

*Birthing and Parenting at Times of Crisis*

the spirit when met with smiles, kind words and open hearts. Our doors and windows can still remain open and allow the bright sunlight beam through.

I would like to recognize the invaluable assistance that you all provided during this project. Your presence proved monumental towards the birth of this collective book. May your days be full of inspiration and renewed courage for the extra mile you have decided to walk together.

On behalf of cosmoanelixis,  
the publishing company and  
the International Journal of Prenatal & Life Sciences

*Olga Gouni*

Change



## Prologue

Regarding change, there is an always present debate over it. In our possible tendency to ever seek the optimal, we are frequently involved – actively or passively - in becoming agents of change (or resisting it). Change seems to bear its own complexity. What happens when we seek a change from the sub-optimal to the optimal? Has it been the cloaked story of our history? Or are the efforts of the (un)born to change the sub-optimal womb conditions still repeated in life after birth and during adulthood? What happens when we resist change from the optimal (or thought of as optimal) to sub-optimal (or thought of as such/or just unknown)? Are there things that should never change or better still are there things that NEVER CHANGE?

In all phases of our life experience we are in a constant interplay between our genetic inheritance and the environment in which we develop. We seem to be shaped by the active dialogue of our nature (genes) and nurture (environment). When nurture is suboptimal, we pay a lifelong price<sup>1</sup>. Developing (un)born babies can respond to adverse conditions in the womb (environment) in order to protect their growing brain and heart. However, this protection mechanism has its own toll, especially if it has to extend over a prolonged period of time during life before birth: Such babies are more prone to heart disease, diabetes, cancer, depression, obesity, addiction, violence ... and altered stress responses during life after birth<sup>2</sup>. The nature/nurture interaction –

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<sup>1</sup> Turner JRG, Turner T., Gouni O. (ed), 2018, *Prenatal Psychology, 100 years*, cosmoanelixis, Athens, Greece

Change

sometimes controversy or adversity as well - impacts our understanding of the origins of good health and Quality of Life.

And how is it that despite the fact that there is only ONE constant: change, we fear it so much?

This paradox of change is a theme of multiple aspects. This is the main theme of the book in your hands. 20 scholars have asked the same questions and came up with 14 chapters. They come from the fields of Prenatal Psychology, Medicine and Health, most of them researchers or academicians and all of them pioneers in their fields. Their common interest in casting light on human experience will take you to a highly rewarding journey of asking similar questions, getting interesting answers and possibly open up to new thought avenues as you recognize your also being an agent of change, yourself. Thank you for being part of this community. Share with those you care and stay onboard!

*Olga Gouni, co-editor*

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<sup>2</sup> Nathanielsz Peter, 1999, *Life in the Womb: The Origin of Health and Disease*, Promethean Press Ithaca, N.Y.



## INTRODUCTION

### Change Happens

by Jon RG Turner (*co-editor*)

*"It is not in the stars  
to hold our destiny, but  
in ourselves!*

This quote by Shakespeare means that whenever the karma of a person is bad, only this person can change his own destiny but not any circumstances. *Nicole Clark*

### Birthing & Parenting in Times of Crisis

*I am passionate about helping people grow  
to be a better version of themselves,  
and that we always have room to grow & improve.  
Haley Gray*

The first quote from Nicole Clark simply illustrates that the topic of change has been with us for hundreds of years; actually we could go all the way back to the dawn of human consciousness, but that is too big a leap in this Introduction. Haley Gray's Keynote gives us the goal we might all be striving toward in our evolution.

Change has as many definitions as there are dictionaries on the internet.

## Change

It is “to make the form, nature, content, future course, etc., of (*something*) different from what it is or from what it would be if left alone<sup>1</sup>.

These two quotes offer a cogent introduction to the examination of Change explored in Chapter 1 of this anthology. Readers will find the author’s concept analysis most gratifying as she offers a solid foundation for Change explored by our contributors.

The title of this Introduction *Change Happens* is a simple phrase describing an unending process that is as eternal for human beings as consciousness itself.

Big change, as in Agatha Christie’s fictional detective Hercule Poirot’s favorite friends, “my little grey cells” ignited my brain when I began receiving the chapters for this book – the writer’s thoughts & feelings about, what and how Change has manifested for them in their lives, and in and from their fields of expertise.

When I told my brother, Donald, in Connecticut that we were editing an anthology on Change, he responded with an enthusiastic:

*“The only universal principle in life is change!  
It is that from which all things flow!”*

Since he is an Educational Psychologist I paid attention. I realized that Change is exactly what our Whole-Self Discovery & Development Institute has been presenting for some 50 years. In these five decades, we have been most focused on the steps of change that occur for the new baby coming into the 3 dimensional world. From before conception, when, in the first person, I was an ancient bodiless consciousness seeking to continue my evolutionary odyssey by entering another chapter in my quest for balancing previous mis-steps & mistakes made along the way on my evolutionary odyssey called life.

Our work in Whole-Self Prebirth Psychology has been all about

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<sup>1</sup> source: [dictionary.com](https://www.dictionary.com)

### *Birthing and Parenting at Times of Crisis*

supporting Change. The first Change was when my consciousness experienced being energetically attracted to the mother & father who would make my evolutionary journey possible by becoming my parents. The key we had discovered was the evolutionary process by which consciousness is attracted to specific parents because they are experiencing the same, especially, charged thoughts and feelings &/or mistakes that remained unresolved.

The second major change my consciousness, still bodiless, experienced was being energetically attached to my mother's bio-energetic/informational field that was vivifying & vitalizing her body. Talk about changes! In computerease – the data upload into my bio-energetic field – my consciousness - of her thoughts & emotions – her reactions was the beginning of my primary education; the challenges I would be meeting in this life.

Physically, prebirth, there had already been a clear series of distinct visible change stages:

It could be said that profound Change had been initiated when Mother Nature brought father's sperm and mother's egg together. The individuation of mother's egg & father's sperm was the major change as they merged into a single zygote. This zygote changed into a morula and then a blastula as (s)he traveled through mother's fallopian tube to arrive in her uterus. For about nine months as part of mother's body she was nurturing him/her to grow, develop, mature, practice & rehearse his/her bodily abilities changing forms all the time. After traveling through my mother's narrow birth canal, the little body was born into the world! This is when the biggest Change of all takes place. It was the moment when my consciousness dynamically switched from my mother's bio-energetic field to my newly delivered little body. My adventure of life had begun!

My parent's pregnancy changed our three lives, and by extension the lives of all humanity. There is a Whole-Self Prebirth Psychology Principle which says:

*I cannot change something in my life until I know what needs to be changed!*

## Change

There are many signals alerting me to what needs to be changed. The guiding Whole-Self Principle supporting Change is that *Change Is The Corrector of Life*. Change helps me repair & correct past “mistakes” my consciousness has ever made.

### ***The Main Opponent to Change is Called Resistance.***

*Change* can be a community action in which everyone serves each other “perfectly” just by being in their lives. People who resist change are called Resistors. Resistors, for me, may be the very people in my life who support and/or are my resistance to change, because in them, I see my behaviors reflected to me and, of course, I do not want to recognize my faults, so, I refuse to change them! So, again, as with my pain, my resistance accumulates as well. I may resist change until my pain/resistance becomes strong or intense enough to make me want to change!

All the people I have met, or ever will meet, throughout my life serve my life purpose perfectly for my growth, development, maturity and evolution. A basic Whole-Self Prebirth Psychology Principle sums it up this way:

I have not come into life to continue repeating the same diminishing pattern – the same pessimistic, negative thought and feeling patterns!

I have come into life to reactivate those past patterns; to recognize those past patterns; to work through those past patterns in order to neutralize, balance and change them into enhancing, optimistic and positive thoughts and feelings. This is *evolutionary change* in action!

I need to be aware that I cannot expect change in others until I stop resistance within myself, then when I do, amazingly my mirrors, the others stop resisting. Again, rephrasing I am back to the above Whole-Self Prebirth Psychology Principle which could say:

*Birthing and Parenting at Times of Crisis*

*I can change something in my life when I know  
what needs to be changed!*

In this world, there are realities and there are truths. Throughout my life, the experiences I have had, have left me with my Beliefs – what I believe about, toward or against anything and everything. Whole-Self calls these *Subjective Realities*. When my beliefs create pain and resistance, these become my *Diminishing Subjective Realities*. These diminishing feelings help me to identify what I need to change. My Whole-Self helps me to recognize, my main purpose of life in this world, which is to have the opportunity to *change my Subjective Realities into Objective Truths*. So, one way for reaching my purpose in life is to recognize my diminishing realities and then to change my realities – my beliefs – into truths that are objectively true.

Subjective Realities can also be Enhancing Subjective Realities. As I celebrate my 87th birthday, I recognize a quite benign presenting Subjective Reality: every day for most of my adult life I have worn a size large shirt. For the last several years, each morning as I dressed I have been progressively confronted with a reality that all my t-shirts are stretching so that the shoulder seams are half way between my shoulders and my elbows so much that now I have to wear a medium size shirt. The objective truth is that in recent years the t-shirts have not stretched but that my body has shrunk – one of Mother Nature's tricks on us elders.

Another one of Mother Nature's tricks is to shrink the cognitive faculties of, as they say in The Netherlands, us who are getting riper. Recently, Troya and I were watching Anderson Cooper interview with neurosurgeon and CNN chief medical correspondent Sanjay Gupta. Dr. Gupta had just published a book called *Keep Sharp: Build a Better Brain at Any Age*. He told Anderson that the most important easy step everyone can take is CHANGE! *Change* the way they had been doing anything whenever possible. *Change* is what keeps the brain young & healthy at any age!

Let us now learn what others have discovered about evolutionary change. Enjoy as you Grow, Develop, Mature and Evolve!

Change

From the famed but ethically bankrupt experiments of Harry Harlow, to the excruciating testimonies of refugees and concentration camp survivors, science and history are replete with the mind-shattering and life-altering impacts of psychological trauma. ... Under highly stressful physical or emotional conditions (food deprivation, decreased habitat, loss of one's mother, social disruption), species-normative brain processes are compromised ...

Each unusual change in the environment telegraphs directly into the brain and body, altering the organism's inner blueprint.

These neuro-epigenetic changes, then, are expressed as variations in personality, stress regulation, and immunological resilience. The result is a puma who is not quite a puma."

*G.A. Bradshaw,  
Carnivore Minds*



## CHAPTER 7

### The Inheritance of Change

by Thomas R. Verny

*"The only thing we know for sure  
is that we are the product  
of a dynamic interaction  
and that nothing about us is written in stone.  
Therefore, as long as we breathe,  
we are a work in progress, constantly changing"*

The union of sperm and egg at conception leads to the formation of a zygote. This tiny cell will carry the blueprint for the future of an entire human being. **Is this genetic information limited to just architectural plans for building a body or does it also include psychological factors for building a mind such as anxieties, phobias or memories or special gifts like musical abilities?**

This question, as will be demonstrated on the following pages, takes us into the realm of *epigenetics*. I think it is fair to say that epigenetics is the most revolutionary advance in the biological sciences since Charles Darwin's *On the Origin of Species* published in 1859. Epigenetics is the study of the molecular mechanisms by which the environment regulates gene activity. Epigenetics teaches us that life experiences not only

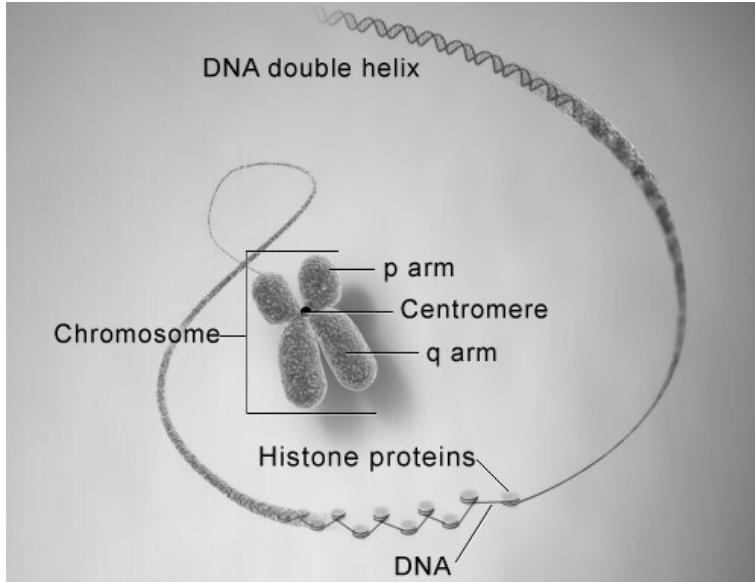
change us but that these changes may be passed on to our children and grandchildren down through many generations. This process is called *trans-generational inheritance*, and has become a hotly debated area of research. It makes good sense from an evolutionary perspective that *exposure of parents to significant environmental conditions such as hunger, warfare, anxiety and the like should ‘inform’ their offspring in order to better prepare them to meet these conditions when they are born*. Obviously, this information can only be conveyed from parents to their children by way of their germ cells (ova and sperm).

There is now a growing field of research particularly on mice, that have identified specific molecular changes in genes as a result of environmental factors. I shall expound on these, in this chapter. Before we do, we shall, first, discuss the basic building blocks of the science of genetics: chromosomes, genes, DNA, RNA, and the like. Then, we shall move on to epigenetics, which I have divided into Environmental and Psycho-Social Epigenetics. While the former deals with factors such as pollution, toxins, too much or too little food, the latter is concerned with relationships, particularly, parent-child relationships but, also, intrapersonal relationships; in other words, how we treat ourselves.

## A. Genetics

It is impossible to discuss genetics without the use of scientific jargon. For this I ask your indulgence and patience. Even if you find some of these terms daunting, please read on. You will get the gist of it. Remember! There is no exam.

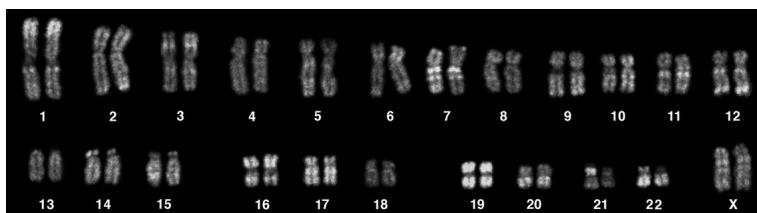
We start with *chromosomes*. A chromosome is an organized package of DNA found in the nucleus of every cell. Different organisms have different numbers of chromosomes. Humans have 23 pairs of chromosomes. These consist of 22 pairs of numbered chromosomes, called *autosomes*, and one pair of *sex chromosomes, X and Y* (Figure 1). Each parent contributes one chromosome to each pair so that each child receives half of their chromosomes from their mother and half from their father.



**Figure 1.** One chromosome pair

Credit: Help Me Understand Genetics page: National Library of Medicine (US). Genetics Home Reference [Internet]. Bethesda (MD): The Library; 2016 May 17. What is a chromosome? [cited 2016 May 23]; Available from: <https://ghr.nlm.nih.gov/primer/basics/chromosome>

Chromosomes are made of DNA strands. Sections of chromosomes are called genes that *code for protein*, that is, they contain the genetic instructions to manufacture everything in our bodies from the neurons in our brain down to the nails on our toes (Figure 2). In order to produce protein, DNA (deoxyribonucleic acid) needs to be transcribed into RNA (ribonucleic acid). RNA gets translated into protein. Proteins are the building blocks of life. They consist of combinations of 20 amino acids. They can take on any imaginable shape and function at the nanoscale.



**Figure 2.** Pictured are 46 human chromosomes

Credit: Andreas Bolzer, Gregor Kreth, Irina Solovei, Daniela Koehler, Kaan Saracoglu, Christine Fauth, Stefan Müller, Roland Eils, Christoph Cremer, Michael R. Speicher, Thomas Cremer [CC BY 2.5 (<http://creativecommons.org/licenses/by/2.5/>)], via Wikimedia Commons

**DNA Sequencing** is the process by which the exact order of the 3 billion chemical building blocks called bases is determined. They are adenine

Change

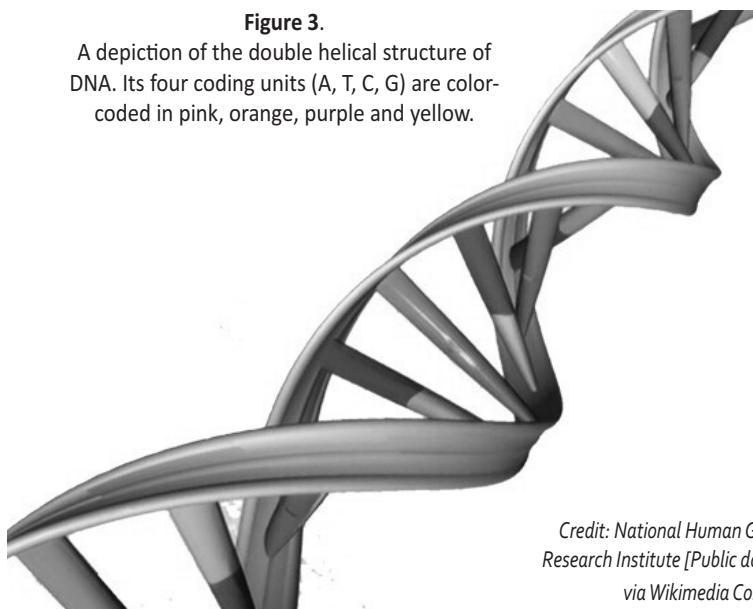
(A), thymine (T), cytosine (C) and guanine (G) (Figure 3). This may be too much information for most of you, I know. However, many of my readers are students, academics and health professionals, so this is for them.

A **genome** is the complete set of DNA in a cell. The 20,000 – 25,000 genes on the human genome make up only 5% of the entire genome. For a long time the rest were dismissed as junk DNA. Scientists have recently discovered that these regions far from being “junk” act as switches which turn genes on or off and thus play a vital role in cell functions.

Robert Sapolsky (2004), professor of biology, neuroscience and neurosurgery at Stanford University, when discussing the Human Genome says in his wonderful book, Why Zebras Don’t Get Ulcers, “*It is like you have a 100-page book, and 95 pages are instructions on how to read the other 5 pages.*

**Figure 3.**

A depiction of the double helical structure of DNA. Its four coding units (A, T, C, G) are color-coded in pink, orange, purple and yellow.

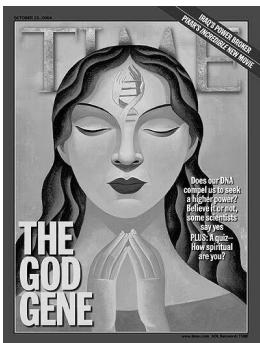


Credit: National Human Genome Research Institute [Public domain], via Wikimedia Commons

Charles Darwin in his seminal book, *On the Origin of Species*, (1859) wrote that evolutionary changes take place over many generations and through millions of years of natural selection. Following in Darwin’s

### *Birthing and Parenting at Times of Crisis*

footsteps, geneticists<sup>1</sup> have had remarkable success in identifying individual genes with variations that lead to simple Mendelian traits and diseases such as phenylketonuria (PKU), sickle-cell anemia, Tay-Sachs disease, and cystic fibrosis. However, diseases with simple Mendelian patterns of inheritance are uncommon, while most human diseases such as cancer, diabetes, schizophrenia, and alcohol dependence or, personality traits and behavior are the result of a multitude of genetic and psycho-socio-economic-cultural elements and therefore, considered complex and multi-factorial



TIME Magazine's covers often pick up on a dominant cultural, political or scientific phenomenon. The October 25, 2004 cover portrays a woman praying with the inscription THE GOD GENE. It reflects on an article inside that issue that hypothesizes on the presence of a "God Gene" in our genome. Of course, nothing could be further from the truth.

There is no God Gene, or Anger Gene, or Selfish Gene or Schizophrenia Gene. It takes many genes to develop a disease or bring about a dysfunctional personality. By the same token a different combination of the same genes can create high intelligence, musical abilities, foresight, etc. Researchers from the University of Geneva report that genetic variation at a single genomic position impacts multiple, separate genes<sup>2</sup> (Dermitzakis, Emmanouil T. et al. 2015). **If one element changes, the whole system changes. Genes teach us a crucial life lesson: Everything is connected.**

A joint team of Dutch, British and American scientists went even further.

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<sup>1</sup> see: the works of:

1. Risch, N. J. (2000). *Searching for genetic determinants in the new millennium*. Nature, 405(6788), 847-856 and
2. Botstein, D. and Risch, N. (2003). *Discovering genotypes underlying human phenotypes: past successes for mendelian disease, future approaches for complex disease*. Nature Genetics, 33, 228-237.

<sup>2</sup> see Dermitzakis, Emmanouil T. et al. (2015). *Population Variation and Genetic Control of Modular Chromatin Architecture in Humans*. Cell, 162(5), 1039-1050.

They wanted to find the genes that influence intelligence. The researchers examined the records of 80,000 people in the UK taking into account several different measures of intelligence. They identified 52 genes linked to intelligence. However, the combined influence of these genes turned out to be minuscule, suggesting that thousands more are likely to be involved and still await discovery. The authors noted that **genetically inherited intelligence is greatly shaped by the environment**<sup>3</sup>

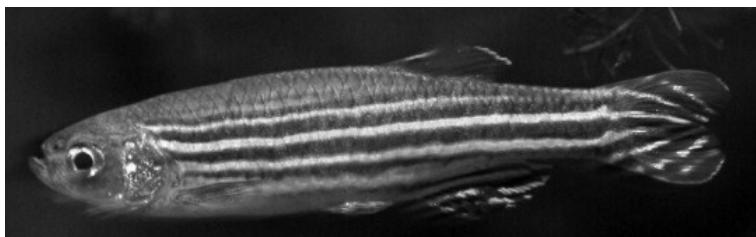
*William Sheldon* (1898-1977) was an American psychologist and physician best known for his theory associating physique, personality, and delinquency. Sheldon classified people according to three body types: **endomorphs**, who are rounded and soft, were said to have a tendency toward a “viscerotonic” personality (i.e., relaxed, comfortable, extroverted), **mesomorphs**, who are square and muscular, were said to have a tendency toward a “somotonic” personality (i.e., active, dynamic, assertive, aggressive); and **ectomorphs**, who are thin and fine-boned, were said to have a tendency toward a “cerebrotonic” personality (i.e., introverted, thoughtful, inhibited, sensitive). This theory fell into disrepute until recent research on zebrafish created renewed interest in it.

Surprisingly, personality changes can affect body shape and body movements, at least in zebrafish, (Figure 4) as a powerful new study from North Carolina State University demonstrated. The researchers bred one group of fish to be bolder and another group to be shy. Zebrafish that were bred to be more bold displayed a sleeker body shape and an ability to dart around the water more quickly when startled than those bred to be more shy. Brian Langerhans, an assistant professor of biological sciences at NC State and a senior researcher of this study said that **“complex behaviors, like the behaviors we call ‘personality’ or ‘temperament,’ can be associated – genetically correlated – with other traits that one might think are independent of such behaviors, like body shape and swimming abilities”**<sup>4</sup>. In other words, traits that seem

<sup>3</sup> see: Sniekers, Suzanne; Stringer, Sven; Chabris, Christopher F et al. (2017). *Genome-wide association meta-analysis of 78,308 individuals identifies new loci and genes influencing human intelligence*. Nature Genetics

<sup>4</sup> see: Kern, Elizabeth M.A. Robinson, Detric, Langerhans R. Brian et al. (2016). *Correlated evolution of personality, morphology and performance*. Animal Behavior, 117: 79

*Birthing and Parenting at Times of Crisis*  
unrelated may not be unrelated.



**Figure 4.** A female zebrafish

Credit: Soulkeeper (Own work) [Public domain], via Wikimedia Commons

According to Michael Meaney, who specializes in biological psychiatry and gene expression at McGill University, Montreal, “**At no point in life is the operation of the genome independent of the context in which it functions**<sup>5</sup>. An individual’s intracellular and extracellular environment including hormones and neurotransmitters, regulates gene activity. And this brings us to the field of epigenetics.

## B. Epigenetics



Another cover of TIME Magazine a few years later (in early January 2010) also depicts a double helix of DNA, as a giant zipper hanging down across the cover, its shiny gold slider opening part way, as if unzipping an actual strand of DNA. This time the cover story reads: **Why Your DNA Isn't Your Destiny: The new science of epigenetics reveals how the choices you make can change your genes – and those of your kids.** This time, TIME is on the right track.

**Epigenetics** is the study of changes in gene activity that do not alter the

<sup>5</sup> see:Meaney M. J. (2001). *Maternal care, gene expression, and the transmission of individual differences in stress reactivity across generations*. Annu Rev Neurosci.; 24:1161-92.

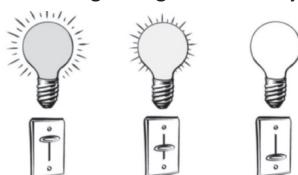
Change

genes themselves but still get passed down to at least one successive generation. These patterns of gene expression are governed by the cellular material – **the epigenome** – that sits on top of the genome, just outside it (hence the prefix epi-, which means above). A central component of epigenetics is **methylation**, in which a chemical group (*methyl*) attaches to parts of the DNA – a process that acts like a dimmer on gene function in response to physical and psychosocial factors. Epigenetic “switches” turn genes gradually on or off (Figures 5 and 6).

It is through epigenetic switches that environmental factors like prenatal nutrition, stress and postnatal maternal behavior can affect gene expression that is passed from one generation to the next. Epigenetic changes represent a biological response to one or more environmental factors. These factors may be positive, life affirming or negative, life threatening. Epigenetic changes serve a very important function during pregnancy by biologically preparing offspring for the environment into which they will be born. **Think of genetics as the hardware and epigenetics as the software in your computer.**

**Figure 5.**

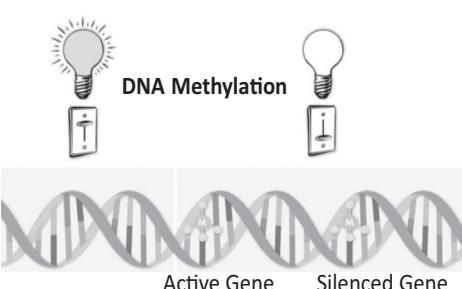
**The Epigenome  
Regulating Gene Activity**



Human Early Learning Partnership. DNA Methylation - Active Gene, Silenced Gene [light switch on/off].  
Credit: Dr. Michael S. Kobor, Human Early Learning Partnership. DNA Methylation - Active Gene, Silenced Gene [light switch on/off]. Vancouver, BC: University of British Columbia, School of Population and Public Health; 2014.

**Figure 6.**

Human Early Learning Partnership.  
The Epigenome - Regulating Gene Activity [light switch on/dimmer/off].  
Credit: Dr. Michael S. Kobor, Human Early Learning Partnership. DNA Methylation - Active Gene, Silenced Gene [light switch on/off]. Vancouver, BC: University of British Columbia, School of Population and Public Health; 2014.



### *Birthing and Parenting at Times of Crisis*

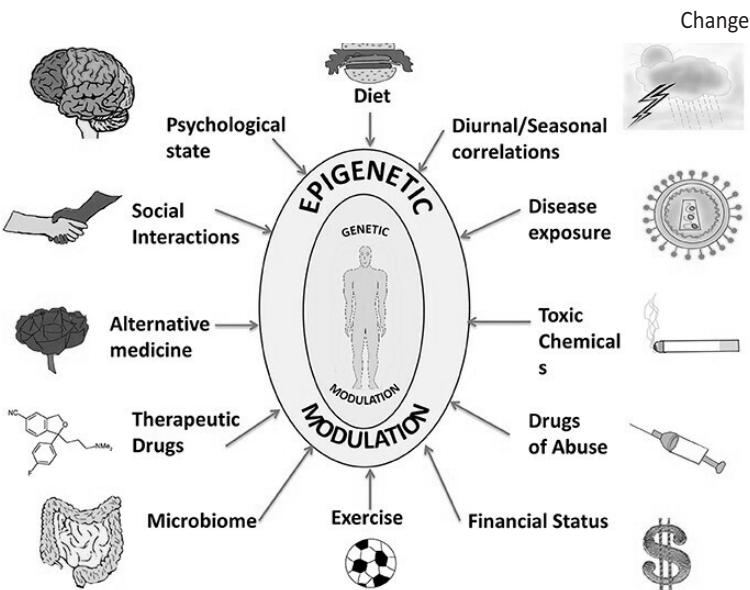
**Methylation** is a dynamic process, and levels of methylation can change from moment to moment and over the course of a person's lifetime depending on the person's experiences whether these be external or internal. The opposite process to methylation is acetylation. Methylation turns down or totally silences the function of a gene while acetylation turns the gene on partially or totally.

Before the advent of epigenetics, geneticists believed that inheritance of traits is governed by genes and that between each generation the epigenetic marks are erased in cells called **primordial gene cells**, the precursors to sperm and eggs. This '*reprogramming*' allows all genes to be read afresh for each new person. However, we have recently learned that some methylation can 'escape' the reprogramming process and can thus be passed on to offspring. Jamie Hackett, at the University of Cambridge in a trailblazing paper writes, "*Our research demonstrates how genes could retain some memory of their past experiences, revealing that one of the big barriers to the theory of epigenetic inheritance – that epigenetic information is erased between generations – should be reassessed*"<sup>6</sup>

With a few exceptions, every cell type in a multicellular organism carries the same genetic instructions encoded in its DNA genome. Nevertheless, each cell type expresses only those genes required for its specific performance of function. Muscle cells and nerve cells, for instance, implement quite different genetic programs directed by subsets of the genes in the whole genome. Which genes are activated and at which time and which lie dormant is largely determined by cell-type-specific chemical modification of the proteins that package the genes in the cell nucleus, the histones. Histones are proteins that have attracted relatively little attention until now. They are distinct from DNA, although they combine with it during cell formation, acting a bit like a spool around which the DNA winds (*Fig.10 below in this chapter*).

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<sup>6</sup> see: Hackett, Jamie A; Sengupta, Roopsha; Surani, M Azim et al., (2013). *Germline DNA demethylation dynamics and imprint erasure through 5-hydroxymethylcytosine* /1/25 Journal Science, Volume 339 Issue 6118 Pages 448-452, American Association for the Advancement of Science.



**Figure 7.** Epigenetics across the human lifespan

Credit: "Figure as originally published in Kanherkar RR, Bhatia-Dey N and Csoka AB (2014) *Epigenetics across the human lifespan*. *Front. Cell Dev. Biol* 2:49. doi:10.3389/fcell.2014.00049".

Some concrete examples of how epigenetics works may clarify all this theoretical scaffolding. Let us consider the case of two monozygotic twins. Monozygotic twins are born from one and the same ovum and the same sperm. Therefore, they have identical genes. If separated and exposed to dissimilar living conditions they will acquire different physiological and emotional characteristics. Even if they are not separated, before birth they inhabit somewhat different areas of their mother's womb. At birth one will precede the other. All of these factors will start a cascade of influences that will contribute to differences in their physical and psychological make-up. In scientific terms, one would say they are genetically identical but *phenotypically* different. Similarly, a caterpillar and a butterfly are genetically the same animal but depending on their developmental stage their genes are expressed differently so every-thing about them is changed.

One of the primary objectives of epigenetics is to study data transfer from one generation to the next by biological rather than psychological

### *Birthing and Parenting at Times of Crisis*

means. Biological inheritance speaks to the idea that the germ cells (sperm and eggs) are affected by significant environmental events, and that these changes in the genome are then passed on to descendants.

The union of sperm and egg at conception leads to the formation of a zygote (a fertilized ovum). This tiny cell will carry the blueprint for the future of an entire human being. Many questions arise: How is this blueprint constructed? What does it consist of? Is the information limited to just architectural plans for building a body or is it more? If more, then what exactly?

Before we move on to address these questions we should mention three other cellular ways by which information may be exchanged between people that do not involve germ cells.

It has recently been discovered that some of the blood cells carried in the blood that passes between mother and child during pregnancy remain in their bodies. Also, a few cells from prior pregnancies persist in mothers for many years. This process is called **Microchimerism**.

Human and animal studies have found fetal origin cells in the mother's skin, bloodstream, and all major organs, including the heart. What these studies show is that women who have carried a child harbor at least three unique cell populations in their bodies – their own, their mother's, and their child's. These cells may transfer information from the person they originated from to the recipient and thus affect their personality and health in ways we are just beginning to explore<sup>7</sup>.

Similarly, *blood donations and organ transplants* can pass information on a cellular level to a recipient. These "donor" cells may, as in the case of microchimerism, affect their recipients' mind and bodies.

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<sup>7</sup> see the works of

1. Yan Z, Lambert NC, Guthrie KA, Porter AJ, Nelson JL et al., (2005). *Male microchimerism in women without sons: quantitative assessment and correlation with pregnancy history*. Am J Med.; 118(8): 899-906
2. Chan WF, Gurnot C, Montine TJ, Nelson JL. et al., (2012). *Male microchimerism in the human female brain*. PLoS One. 7(9): e45592.&
3. Rowland, Katherine (2018). *We Are Multitudes*. AEON Magazine

## I. Environmental Epigenetics

A 1988 paper published by John Cairns in *Nature*<sup>8</sup>, one of the very top science journals, started a tectonic shift in genetics. The paper described an experiment in which a particular strain of bacteria E. Coli that could not metabolize lactose, was placed on a lactose medium (scientific jargon for food on which bacteria grow, usually in a Petri dish). Instead of starving, they very quickly underwent genetic changes, which allowed them to digest lactose and thus survive. Cairns reported that at least in some cases, selective pressures could specifically direct mutations.

Good-bye Darwinist orthodoxy. Cairns even “brazenly,” as some critics said, raised the specter of possible Lamarckian hereditary mechanisms – one could not have gotten more heretic than that in 1988. In the same issue of *Nature*, Franklin Stahl<sup>9</sup>, another one of the founding fathers of bacterial genetics, endorsed Cairns’ conclusions and presented his own model of how “directed mutations” may take place.

Cairns today is Professor of Microbiology at the Radcliffe Infirmary, one of the medical teaching hospitals of Oxford University, and remains a recognized leading authority in mutation genetics. His 1988 article is one of the most frequently cited papers in the field, and has launched an entire new area of study.

A decade after the publication of Cairns’ paper P L Foster<sup>10</sup>, professor of biology at Indiana University wrote, “*Much subsequent research has shown that mutation rates can vary, and that they increase during certain stresses such as nutritional deprivation. The phenomenon has come to be called “adaptive mutation.”*” Today, adaptive mutation has been transformed into epigenetics.

At about the same time as Cairns was performing his experiments, Dr.

<sup>8</sup> Cairns John, Overbaugh Julie, and Miller, Stephan (1988). *The origin of mutants*. Nature 335, 142 – 145.

<sup>9</sup> Stahl, FW (1988) Bacterial genetics. *A unicorn in the garden*. Nature 335:112

<sup>10</sup> Foster PL. (1999). *Mechanisms of stationary phase mutation: a decade of adaptive mutation*. Annu Rev Gene; 33:57–88.

### *Birthing and Parenting at Times of Crisis*

Lars Olov Bygren<sup>11</sup>, Head of the Department of Social Medicine at the University of Umea, Sweden, wondered, “**Could parents’ experiences early in their lives somehow change the traits they passed to their offspring?**” Bygren and other scientists have now amassed a great deal of historical evidence suggesting that powerful environmental conditions (near death from starvation, for instance) can leave an imprint on the genetic material in eggs and sperm. **These genetic imprints can short-circuit evolution and pass along new traits in a single generation.**

Bygren’s records from a small region in Sweden showed that food availability between the ages of nine and twelve for the paternal grandfather affected the lifespan of his grandchildren. But not in the way you might think.

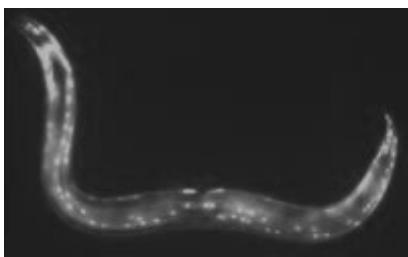
Food abundance for the grandfather was associated with a reduced lifespan for his grandchildren. Early death was the result of either diabetes or heart disease. On the other hand, food shortage for the grandfather was associated with extended lifespan of his grandchildren. Obviously, something changed genetically in these children over two generations. Let’s see if we can throw some more light on this.

During World War II, from November 1944 to the late spring of 1945 the German army forced the Dutch population to survive on less than a third of their regular caloric intake. After the war, scientists investigated the children born to women who were pregnant during this period. These children grew smaller than the Dutch average. Their children were also smaller and more susceptible to diabetes, obesity and cardiovascular disease. The “*hunger winter*” studies suggested there was an epigenetic change at work, said Duke University biologist Ryan Baugh, one of the principal researchers<sup>12</sup>.

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<sup>11</sup> Bygren L. O, Kaati G, Edvinsson S: (2001) *Longevity determined by ancestors' overnutrition during their slow growth period*. Acta Biotheoret ; 49: 53–59

<sup>12</sup> Jobson, M. A.; Jordan, J. M.; Sandrof, M. A.; Baugh. L. R. et al., (2015). *Transgenerational Effects of Early Life Starvation on Growth, Reproduction and*



**Figure 8.**  
*C. elegans*

*Credit: Kapahi Lab Buck Institute for Research on Aging, Novato, CA*

*C. elegans*<sup>13</sup> is a very primitive worm about 1 mm in length that lives in the soil (Figure 8). The worm is conceived as a single cell that undergoes a complex process morphogenesis<sup>14</sup>. It has a nervous system with a 'brain' (*the circumpharyngeal nerve ring*). It exhibits behavior and is even capable of rudimentary learning. *C elegans* produces sperm and eggs, mates and reproduces. All 959 of its transparent body cells (somatic cells) are visible with a microscope, and its average life span is a mere 2-3 weeks. According to Dr. Christoph Kaleta, Professor of Medical Systems Biology at the Faculty of Medicine at Kiel University, Germany worms and humans share up to 80 per cent of their genes<sup>15</sup>. Not surprisingly, approximately half of all the known genes which are involved in human diseases can also be found in *C. elegans*. Scientists love studying this creature. As an example, between October 1994 and January 1995, 73 scientific articles about *C. elegans* appeared in international journals.

Experimenting with *C. elegans* a team of UC Santa Cruz scientists led by Susan Strome created worms with a mutation that knocks out the enzyme responsible for making the methylation switch, then bred them with normal worms. Using fluorescent labels, the researchers were able to track the fates of marked and unmarked chromosomes under the

*Stress Resistance in Caenorhabditis elegans*. Genetics.

<sup>13</sup> *C-elegans* (<http://cbs.umn.edu/cgc/what-c-elegans>)

<sup>14</sup> morphogenesis is the development of form and structure in an organism during its growth from embryo to adult morphogenesis.

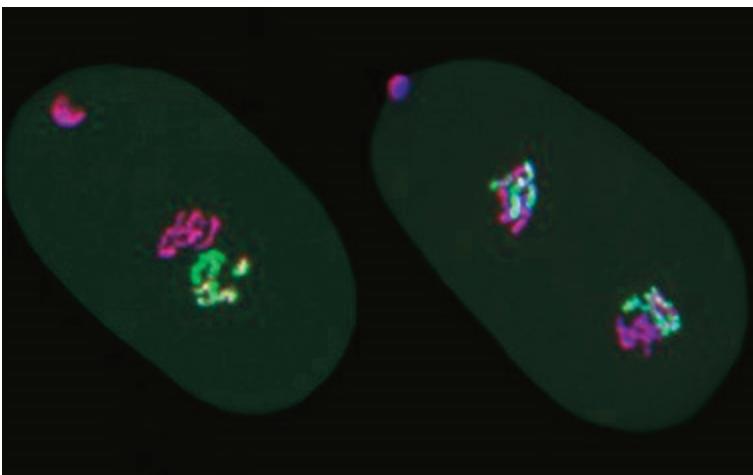
<https://www.britannica.com/science/morphogenesis>

<sup>15</sup> Gebauer, Juliane, Gentsch, Christoph, Kaleta, Christoph et al. (2016). *A Genome-Scale Database and Reconstruction of Caenorhabditis elegans Metabolism*. Cell Systems, 2 (5): 312

*Birthing and Parenting at Times of Crisis*

microscope, from egg cells and sperm to the dividing cells of embryos after fertilization. Strome<sup>16</sup> noted that all animals use the same enzyme to create the same methylation switch as a signal for gene repression

Figure 9.



Images of *C. elegans* embryos show inheritance and transmission of an epigenetic mark. The 1-cell embryo (left) shows the mark (green) inherited on sperm chromosomes but not on the oocyte chromosomes (pink) from a mutant mother lacking the methylation enzyme PRC2. The 2-cell embryo (right) shows transmission of the mark on the sperm-derived chromosomes in each daughter nucleus.

*Credit: Laura Gaydos and Susan Strome*

Geneticists have focused on epigenetic inheritance in the paternal line because the sperm contributes little more than its chromosomes to the embryo. The egg contains many other components that may influence the development of the embryo, making it harder to separate epigenetic effects in the maternal line. Differences in gene expression were a direct result of the changes in histone marks on the sperm chromosomes.

Strome commented, “**We have a specific example of epigenetic memory that is passed on**, and we can see it in the microscope. It’s one

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<sup>16</sup> Gaydos, L. J., Wang, W., and Strome, S. (2014). *H3K27me and PRC2 transmit a memory of repression across generations and during development*. Science, 345(6203), 1515-1518.

piece of the puzzle”<sup>17</sup>.

Research by Ryan Baugh at Duke University has demonstrated convincingly that starvation early in life can alter an organism for many generations. Baugh starved one group of *C. elegans* for one day and another for eight days at the first stage of larval development after hatching. When feeding was resumed, the worms that were starved longer grew more slowly, and ended up smaller and less fertile. They also proved more susceptible to a second bout of starvation. Their offspring were smaller, fewer and less fertile. However, these children and grandchildren of famine turned out to be more resistant to starvation. “*They have a memory of famine,*” Baugh said.

But it is not just food that can starve children. So can poverty, as demonstrated in a British study led by Marcus Pembrey and his team from the University of Bristol, UK<sup>18</sup>. The researchers selected 40 men from a group of 3,000 born in 1958 – half born into rich households and half born into poor ones. In the study subjects were chosen from the top and bottom 20 per cent according to socioeconomic status, so ensuring they had examples of both extremes.

Focusing on stretches of DNA called *promoter regions*, which turn genes on or off, the team examined more than 20,000 sites throughout the genome. The patterns were different between the two groups on almost one third of the sites. Most tellingly, methylation levels were drastically different at 1,252 sites of the men who came from poor households, but only at 545 sites in men from rich families. Because the samples were taken in middle age, the researchers couldn’t tell exactly when the epigenetic methyl groups were added or subtracted. It is possible that the genes were altered in infancy, childhood, or even adulthood. Yet all the signs point to prenatal or early postnatal life. As Pembrey says, “*It’s telling us that the epigenetic changes in adult DNA are largely from*

<sup>17</sup> Gaydos, Laura J.; Wang, Wenchao; Strome, Susan (2014). *H3K27me and PRC2 transmit a memory of repression across generations and during development.* Science, Vol. 345 no. 6203 pp. 1515-1518.

<sup>18</sup> Borghol, N., Suderman, M., McArdle, W., Racine, A., Hallett, M., Pembrey, M., ... and Szyf, M. (2012). *Associations with early-life socio-economic position in adult DNA methylation.* International journal of epidemiology, 41(1), 62-74

*Birthing and Parenting at Times of Crisis*

***early life experience”<sup>19</sup>.***

Delivery by elective cesarean section is increasing dramatically worldwide, and is today the most common surgical procedure in fertile women. Among those born by cesarean section, an increased risk of certain diseases, such as asthma, type 1-diabetes, obesity, celiac disease, and cancer has been noticed. Tomas Ekström, Professor of Molecular Cell Biology at the renowned Karolinska Institute in Sweden investigated epigenetic alterations of 64 healthy, singleton, newborn infants born at term. Ekström compared cord blood taken from elective C-section and vaginal delivery babies. Blood stem cells from infants delivered by C-section were globally more DNA methylated than DNA from infants delivered vaginally. The researchers found specific epigenetic differences between the groups in 343 DNA regions, including genes known to be involved in processes controlling metabolism, the immune system and white blood cells<sup>20</sup>.

These studies indicate that **the epigenome of an infant is sensitive to the prenatal environment and the experience of birth.**

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<sup>19</sup> Pembrey, M., Saffery, R. and Bygren, L. O. (2015). *Network in Epigenetic Epidemiology. Human transgenerational responses to early-life experience: potential impact on development, health and biomedical research.* J Med Genet. 51, 563–72

<sup>20</sup> see the following works:

1. Schlinzig T, Johansson S, , Ekström TJ, Norman M. (2009). *Epigenetic modulation at birth – altered DNA-methylation in white blood cells after Caesarean section.* Acta Paediatrica. 98:1096–1099.

2. Almgren, M., Schlinzig, T., Gomez-Cabrero, D., Gunnar, A., Sundin, M., Johansson, S., ... and Ekström, T. J. (2014). *Cesarean delivery and hematopoietic stem cell epigenetics in the newborn infant: implications for future health?* American journal of obstetrics and gynecology, 211(5), 502-e1

## II. Psychosocial Epigenetics

### 1. Transgenerational

#### a. Transgenerational 1 Epigenetics

I need to explain that Transgenerational 1 Epigenetics as used here refers to genetic factors being passed from parent to child. The research is limited to studying the effect on the children, i.e., first generation effects.

I am sure all of us have wondered, at one time or another, why some people are always calm, no matter what, while others get anxious at the drop of a hat. Recent research on rats provides a clue. Mother rats seem to fall into two groups. There are those, which spend a lot of time licking, grooming, and nursing their pups. Others seem to ignore their pups. Highly nurtured rat pups tend to grow into calm adults, while rat pups deprived of nurturing care grow up anxious. The nurturing behavior of a mother rat during the first week of life shapes her pups' epigenome. And the epigenetic pattern that the mother establishes tends to endure, even after the pups become adults. The difference between a calm and an anxious rat is not genetic; it is epigenetic<sup>21</sup>.

These data indicate that a higher level of maternal care-taking behavior during the first week of life promotes adult behavior that is characterized by stress resilience and increased maternal care in the offspring. In this instance, what is true for mice also applies to humans.

In 2011 a University of Delaware group decided to study whether early-life adversity alters gene expression. They exposed male and female infant rats to stressed "abusive" caretakers for 30 minutes daily during the first seven days of life. They induced abuse in mother rats by placing them in an unfamiliar environment with limited space. As a result, caretakers began to step on, drop, drag, actively reject, and roughly handle their infants. This treatment, naturally, elicited distress responses

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<sup>21</sup> Weaver ICG, Cervoni N, Champagne FA, Meaney MJ et al., (2004). *Epigenetic programming by maternal behavior*. Nature Neuroscience. 7:847–854.

*Birthing and Parenting at Times of Crisis*  
in the infants<sup>22</sup>.

The maltreated infant rats were found to have significant methylation of *Bdnf* DNA (*brain-derived neurotrophic factor (Bdnf) protein*) in the prefrontal cortex, and that the hyper methylated DNA persisted through development and into adulthood. The observed decrease in *Bdnf* gene expression was in line with previous findings where early life experiences are known to have a lasting impact on this gene leading to changes in personality and behavior<sup>23</sup>.

***“Human connections create neural connections from which the mind emerges,”*** wrote Daniel Siegel<sup>24</sup>, currently clinical professor of psychiatry at the UCLA School of Medicine. Abusive and neglectful caregivers are known to leave children particularly susceptible to cognitive and emotional dysfunction. Indeed, childhood maltreatment is significantly associated with the later diagnosis of adolescent and adult schizophrenia, borderline personality disorder, posttraumatic stress disorder, and major depression<sup>25</sup>.

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<sup>22</sup> see the following two different papers by the same authors: Roth, Tania L. and Sweatt , J. David (2011). *Epigenetic marking of the BDNF gene by early-life adverse experiences. Hormones and Behavior*, Special Issue: Behavioral Epigenetics, Volume 59, Issue 3, Pages 315–320 and

Roth, Tania L. and Sweatt, J. David (2011). *Epigenetic mechanisms and environmental shaping of the brain during sensitive periods of development.* J Child Psychol Psychiatry, 52(4): 398–408.

<sup>23</sup> Branchi I, Francia N, Alleva E. (2004). *Epigenetic control of neurobehavioral plasticity: the role of neurotrophins.* Behavioral Pharmacology. 2004; 15:353–362.

<sup>24</sup> Siegel, D. J. (2001). *Toward an interpersonal neurobiology of the developing mind: Attachment relationships, “mindsight,” and neural integration.* Infant mental health journal, 22(1-2), 67-94.

<sup>25</sup> see the following works:

1. Kaufman J, Plotsky PM, Nemeroff CB, Charney DS. (2000). *Effects of early adverse experiences on brain structure and function: clinical implications.* Biological Psychiatry. 48:778–790. [PubMed:11063974]

2. Heim C, Nemeroff CB. (2001). *The role of childhood trauma in the neurobiology of mood and anxiety disorders: preclinical and clinical studies.* Biological Psychiatry. 2001; 49:1023–1039.

3. Schore AN. (2002). *Dysregulation of the right brain: a fundamental mechanism of traumatic attachment and the psychopathogenesis of posttraumatic stress*

Patrick McGowan<sup>26</sup> from McGill University, examined 24 samples of brain tissue taken from autopsies of male suicide victims, half of who had been abused as children and half of who had not. They compared these men to a dozen others, who had never been abused and had died accidentally.

McGowan focused his attention on a gene called NR3C1 that affects a person's ability to deal with stress and is part of the fight-flight system. His research showed that the activity of the NR3C1 gene was much lower in abuse victims who took their own lives, than in either of the other groups. Not surprisingly, some scientists have found a link between low levels of this gene also in people suffering of schizophrenia and mood disorders.

Sensitive and caring parenting, on the other hand, can make a big difference to a child. For example, neurobiologist Regina Sullivan<sup>27</sup>, professor at the NYU School of Medicine, found that rat infants experiencing pain had several hundred genes more active than rat infants free of pain. With their mothers present, however, fewer than 100 genes were similarly expressed. Sullivan has successfully demonstrated that a mother comforting her infant in pain alters gene activity in a part of the brain involved in emotions (*amygdala*) and thus elicits a positive short-term behavioral response in her child.

**This has important implications for understanding the biology of attachment and bonding.** Mother's affection changes gene activity in her infant's brain, which leads the infant to develop attachment to the mother. The smiling child's response elicits epigenetic changes in the mother. The repetition of this interaction over time eventually contributes to the development of mutual love: the love of the mother

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*disorder.* Australian and New Zealand Journal of Psychiatry. 36:9–30. and

4 Bremner JD. (2003). *Long-term effects of childhood abuse on brain and neurobiology.* Child and Adolescent Psychiatric Clinics of North America. 12:271–292.

<sup>26</sup> McGowan PO, Szyf M. (2010). *The epigenetics of social adversity in early life: Implications for mental health outcomes.* Neurobiology of Disease. 39(1), 66-72;

<sup>27</sup> Sullivan, Regina (2014). *Mother's soothing presence makes pain go away, changes gene activity in infant brain.* ScienceDaily.

*Birthing and Parenting at Times of Crisis*  
for her child (*bonding*) and the child's love for their mother  
(*attachment*).

Michael S. Kobor, associate professor of medical genetics, UBC, Vancouver, found higher stress levels reported by mothers during their child's first year correlated with methylation levels on 139 DNA sites in adolescents while higher reported stress by fathers during their child's pre-school years (three-and-a-half to four-and-a-half years old) correlated with methylation levels on 31 DNA sites in adolescence. "*To our knowledge, this is the first demonstration, using carefully collected longitudinal data, that "parental adversity during a child's first years leads to discernible changes in his or her 'epigenome,' measurable more than a decade later. This literally illustrates a mechanism by which experiences 'get under our skin' and stay with us for a long time*"<sup>28</sup>.

How do relationships impact us on a molecular level? A paper published in *Nature Neuroscience* explored epigenetic changes in the brains of prairie voles<sup>29</sup>. Voles mate for life and share parental responsibilities. This unique behavior makes voles an excellent animal model to study exclusivity, monogamy, and partner preference.

Prairie vole couples have measurably higher levels of oxytocin and vasopressin, the social bonding neurotransmitters, compared to unattached voles. Oxytocin has been described as the "*love hormone*" and it is excreted together with other hormones such as *endorphins* and *adrenaline* in situations that accompany feelings of pleasure and attraction to others. Oxytocin increases male and female social and sexual responsiveness, as well as caretaking in both sexes. Vasopressin, on the other hand, increases male sexual persistence such as courtship. In females, it energizes more aggressive aspects of maternal behavior such as protecting young from harm.

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<sup>28</sup> Essex, Marilyn J.; Boyce, W. Thomas, Kobor, Michael S. (2011). *Epigenetic Vestiges of Early Developmental Adversity: Childhood Stress Exposure and DNA Methylation in Adolescence*. Child Development;

<sup>29</sup> Wang H., Duclot F., Liu Y., Wang Z. and Kabbaj M. (2013). *Histone deacetylase inhibitors facilitate partner preference formation in female prairie voles*. Nature Neuroscience,

Until recently, it was thought that only humans, great apes, and large-brained mammals such as dolphins and elephants were capable of showing consolation behavior towards one another. In follow up experiments, James Burkett<sup>30</sup>, at Emory University, Atlanta, GA, has challenged this long held scientific belief. Pairs of voles were isolated from each other. Then, one of them was exposed to mild shocks. When they were reunited, the voles who did not receive shocks proceeded to lick their shocked partners sooner and for longer than those in a control group who were separated but whose partners were not shocked. Apparently, the partners of the shocked voles somehow knew that the other experienced discomfort. The consoling behavior only took place between voles who were familiar with each other, and not between strangers.

Burkett and his team demonstrated that blocking oxytocin stopped the animals from consoling each other. ***"This is the strongest evidence yet that the fundamental building blocks of empathy are conserved in evolution between rodents and humans."*** This is actually not that surprising considering that we humans share 95 per cent of our genes with rodents (think rats and shudder).

### b. Transgenerational 2 Epigenetics

Transgenerational 2 Epigenetics is used here to refer to measuring the effects of parental behavior, stress or trauma on children and grandchildren, i.e. first and second generation effects.

Brian G Dias and Kerry J Ressler of Emory University, studied the effect of parental olfactory experience on the behavior and neural structures across generations of mice. They gave male lab mice electric shocks every time they were exposed to the smell of *acetophenone*, a chemical used in perfumes. As a result of this classical conditioning technique, the mice became anxious at the mere scent of acetophenone. The mice's noses and brains also adapted accordingly, generating additional

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<sup>30</sup> Burkett, J. P., Andari, E., Young L. J. et al. (2016). *Oxytocin-dependent consolation behavior in rodents*. Science: Vol. 351, Issue 6271, pp. 375-378

### *Birthing and Parenting at Times of Crisis*

M71 neurons - cells receptive to this particular scent — so that they would be extra sensitive to the smell. Their children and grandchildren feared the smell, too, even though they were never conditioned to fear it<sup>31</sup>.

The mice showed no reaction to other smells and had no fear responses to sounds or different types of warnings. To confirm this, the scientists even took sperm from the first set of mice, used in vitro fertilization (IVF) to implant them in females from another lab, raised them in isolation away from any untoward influences, and still found an increased sensitivity to the original scent. It is important to point out that these results did not arise from any socially learned behaviors picked up by hanging around one's anxious parents.

Dias opined, *"Our findings provide a framework for addressing how environmental information may be inherited transgenerationally at behavioral, neuroanatomical and epigenetic levels."*

Researchers from the University of Lethbridge in Canada studied pregnancies in four generations of rats and showed that inherited epigenetic effects of stress could affect pregnancies for generations. Gerlinde Metz, senior author of the paper says: *"In our study we provide new insights into how stress in our mothers, grandmothers and beyond could influence our risk for pregnancy and childbirth complications. The findings have implications outside of pregnancy, in that they suggest that the causes of many complex diseases could be rooted in the experiences of our ancestors"*<sup>32</sup>.

Most of the research in the field of epigenetics has focused on epigenetic mechanisms involving DNA and methyl and acetyl groups that attach to DNA. McGill researchers and their Swiss collaborators have discovered that proteins known as *histones*, which have attracted

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<sup>31</sup> Burkett, J. P., Andari, E., Young L. J. et al. (2016). *Oxytocin-dependent consolation behavior in rodents*. Science: Vol. 351, Issue 6271, pp. 375-378

<sup>32</sup> Yao, Youli; Robinson, Alexandra M; Metz, Gerlinde A S, et al., (2014). *Ancestral exposure to stress epigenetically programs preterm birth risk and adverse maternal and newborn outcomes*. BMC Medicine, 2014; 12 (1): 121

relatively little attention until now, may play an equally crucial role in the process. Histones are part of the content of sperm transmitted at fertilization. Histones are distinct from DNA, although they combine with it during cell formation, acting a bit like a spool around which the DNA winds. The researchers created mice in which they slightly altered the biochemical information on the histones during sperm cell formation. The offspring were adversely affected both in terms of their development, and in terms of their survival.

These effects could still be seen two generations later. Keith Siklenka (2015), the lead investigator stated, “*These findings are remarkable because they indicate that information in addition to DNA is involved in heritability. The study highlights the critical role that fathers play in the health of their children and even grand-children.*”

Are the biological mechanisms in the transmission of familial factors to offspring different for mothers and fathers? A new study from Mount Sinai School of Medicine, New York shines a spotlight on this question. There, David M Dietz<sup>33</sup> and colleagues subjected adult male mice to chronic social defeat stress. Then they and a control group of male mice were bred with normal female mice. Once their offspring were born, they were assessed by a variety of standard tests for depressive- and anxiety-like symptoms. Plasma levels of corticosterone and vascular endothelial growth factor were also measured in the two groups of infant mice.

Both male and female offspring from the defeated fathers demonstrated pronounced depressive and anxiety-like behaviors. The offspring of defeated fathers also displayed increased basal levels of plasma corticosterone and decreased levels of vascular endothelial growth factor, both of which have been implicated in depression. “***These and related findings in mice raise the possibility that part of an individual's***

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<sup>33</sup> see both works below:

1. Dietz DM, LaPlant Q, Feng J, et al. (2011): *Paternal transmission of stress-induced pathologies*. Biol Psychiatry 70:408–414
2. Dietz, David M and Nestler, Eric J (2012). *From Father to Offspring: Paternal Transmission of Depressive-Like Behaviors*. Neuropsychopharmacology Reviews 37, 311–312;

*Birthing and Parenting at Times of Crisis*

**risk for clinical depression or other stress-related disorders may be determined by his or her father's life exposure to stress, a provocative suggestion that now requires direct study in humans”<sup>34</sup>.**

In follow up experiments Dietz took sperm from defeated and control mice to impregnate female mice through in vitro fertilization (IVF). The resulting offspring were tested for depression and anxiety. Unlike in previous experiments, animals born using IVF from defeated fathers showed only modest increases in depression and anxiety. So, what are we to make of this?

There seems to exist a significant difference between mice created by in vitro fertilization and mice conceived naturally. On the face of it, transmission of a paternal effect by way of sexual intercourse but not in vitro fertilization suggests that something in the quality of the “sex” matters. The authors propose that the father’s mating behavior as a result of exposure to social defeat is somehow detectible by the female who may both sense (i.e., literally smell perhaps), and then respond in a subtle way, to something that is not aversive enough to be a deal breaker for copulation but may nonetheless be translated into a biological change that allows transmission to offspring. Thus, even in what must be seen as essentially a paternally transmitted effect, maternal behavior may be a necessary component.

We should also keep in mind that in vitro fertilization involves subjecting eggs and sperm to a series of chemical and physical processes and then immersing the zygote/blastocyst in a variety of media. It is likely that these interventions may eliminate or override some of the epigenetic processes.

Exposure of mothers to nicotine and other components of cigarette smoke is recognized as a significant risk factor for behavioral disorders, including attention deficit hyperactivity disorder, (or ADHD) in many generations of descendants. To study whether the same applies to

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<sup>34</sup> Franklin, Tamara B; Saab, Bechara J; Mansuy, Isabelle M. (2012). *Neural Mechanisms of Stress Resilience and Vulnerability*. Neuron, Volume 75, Issue 5, p747–761

fathers, researchers at the Florida State University in Tallahassee exposed male mice to low-dose nicotine in their drinking water during the stage of life in which the mice produce sperm.

They, then, bred these mice with females that had never been exposed to nicotine. While the fathers were behaviorally normal, both sexes of offspring displayed hyperactivity, attention deficit, and cognitive inflexibility. When female (but not male) mice from this generation were bred with males never exposed to nicotine, male offspring displayed fewer, but still significant, deficits in cognitive flexibility. Analysis of spermatozoa from the original nicotine-exposed males indicated that multiple genes had been epigenetically modified, including the dopamine D2 gene, critical for brain development and learning, suggesting that these modifications likely contributed to the cognitive deficits in the descendants. *“Our findings underscore the need for more research on the effects of smoking by the father, rather than just the mother, on the health of their children.”*<sup>35</sup>

How about Grammy’s smoking? Well, we have a study on that too. After analyzing data from more than 14,500 children born in the United Kingdom during the 1990s, Jean Golding, the study’s lead author from the University of Bristol, found that people with a maternal grandmother who smoked during her pregnancy had a 53 per cent increased risk of developing autism. The study also revealed that girls whose maternal grandmother smoked during pregnancy were 67 per cent more likely to have autism-linked traits. For two of the traits (Social Communication and Repetitive Behaviour) the investigators demonstrated that granddaughters were much more affected than grandsons<sup>36</sup>.

Nowadays, in most parts of the world marijuana is perceived as benign. In fact, less harmful than alcohol. Duke University researchers analyzed

<sup>35</sup> McCarthy, Deirdre M.; Morgan, Thomas J.; Bhide, Pradeep G. et al., (2018). *Nicotine exposure of male mice produces behavioral impairment in multiple generations of descendants*. PLOS Biology; 16 (10): e2006497

<sup>36</sup> Golding, Jean, Ellis, Genette; Pembrey, Marcus et al., (2017). *Grand-maternal smoking in pregnancy and grandchild’s autistic traits and diagnosed autism*. Scientific Reports 7, Article number: 46179.

### *Birthing and Parenting at Times of Crisis*

differences between the sperm of males who smoked or ingested marijuana compared to a control group with no such exposures. They identified significant hypomethylation in the sperm of men who used marijuana compared to controls, at a gene that has been strongly implicated in autism, schizophrenia and post-traumatic stress disorder.

This hypomethylated state was also detected in the forebrain region of rats born to fathers exposed to THC, supporting the potential for intergenerational inheritance of an altered sperm DNA methylation pattern<sup>37</sup>.

Let us now move to a subject that is much in the news today, namely, trauma. Trauma unlike stress is not easy to define, and tends to last long periods of time. Trauma is generally defined as an event that induces intense fear, helplessness, or horror. Post-traumatic stress disorder (PTSD) is a particular expression of trauma. Essentially, PTSD occurs when a person feels overwhelmed and helpless in a life-threatening situation. As witnessed by many veterans, PTSD has long lasting and often debilitating effects.

During the last 50 years, the transgenerational transmission of trauma has been explored in more than 500 articles. Many studies question the concept, others support it. Anna Freud in 1942 first described Transgenerational Trauma. In the same year, Dorothy Burlingham, an American child psychoanalyst and educator and a lifelong friend and partner of child psychoanalyst Anna Freud, referred to unconscious “messages” passed between mothers and children during the German bombing of London in World War II.

In 1968, Margaret Mahler<sup>38</sup>, a child psychoanalyst in the USA, observed that in early infancy a mother and her child function almost as one psychological unit. She held that there is fluidity between a mother’s

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<sup>37</sup> Schrott, R., Acharya, K. and Murphy, S. K. et al., (2020). *Cannabis use is associated with potentially heritable widespread changes in autism candidate gene DLGAP2 DNA methylation in sperm*. Epigenetics, 15(1-2), 161-173.

<sup>38</sup> Mahler, M.S. (1968.) *On Human Symbiosis and the Vicissitudes of Individuation. Infantile Psychosis*, Volume 1. New York: International Universities Press.

and a child's psychic borders. In the early '80s, a Lakota professor of social work named Maria Yellow Horse Brave Heart<sup>39</sup> coined the phrase "**historical trauma.**" What she meant by that was "*the cumulative emotional and psychological wounding over the lifespan and across generations.*"

In the past, psychologists and psychiatrists thought of transgenerational transmission of trauma in terms of a purely psychological phenomenon. According to this theory starting at conception the mother's anxiety, unconscious fantasies, perceptions and expectations are passed to the child's mind and body by verbal or non-verbal cues. Parents who have experienced trauma may constantly talk about it or, as is more often the case, never talk about it. Just living with a person, (survivor or veteran) who suffers from PTSD can be traumatizing. The children in such families experience their own PTSD by 'walking on egg shells' around the PTSD parent and wondering what they are hiding<sup>40</sup>.

The idea that a parental traumatic experience could be passed on to subsequent generations gained acceptance in scientific circles in the late 70s and early 80s. Since the mid-1980s controlled studies on the children of Holocaust survivors (in reality – adults) showed increased vulnerability to PTSD, distrust of the world, impaired parental function, chronic sorrow, inability to communicate feelings, an ever-present fear of danger, separation anxiety, boundary issues and other psychiatric disorders<sup>41</sup> .

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<sup>39</sup> Brave Heart, M. Y. H., Chase, J., Elkins, J., and Altschul, D. B. (2011). *Historical trauma among indigenous peoples of the Americas: Concepts, research, and clinical considerations*. Journal of psychoactive drugs, 43(4), 282-290.

<sup>40</sup> Volkman, Vamik D. (1998). *Transgenerational Transmissions and "Chosen Trauma"*. Opening Address, XIII International Congress. International Association of Group Psychotherapy. <http://www.vamikvolkan.com/Transgenerational-Transmissions-and-Chosen-Traumas.php>

<sup>41</sup> see the following works:

1. Barocas, H. A., and Barocas, C. B. (1979). *Wounds of the fathers: The next generation of Holocaust victims*. International Review of Psycho-Analysis
2. Freyberg, J. T. (1980). *Difficulties in separation-individuation as experienced by holocaust survivors*. American Journal of Orthopsychiatry, 50(1). 87-95 and
3. Fogelman, E., and Savran, B. (1980). *Brief group therapy with offspring of*

### *Birthing and Parenting at Times of Crisis*

Today, we are learning that the spoken or unspoken messages of PTSD parents may impact the child both on a biological as well as a psychological level. In the same way parents pass on genetic characteristics to their children, they also pass on all kinds of "acquired," that is, epigenetic characteristics especially, if these originated in powerful emotionally charged experiences such as exposure to starvation, violence or the tragic loss of loved ones. Such traumatic events leave an imprint on the genetic material in germ cells of individuals and may be transferred to their children and their children's children.

Rodent and non-human primate studies show that early trauma produces lasting changes in neural function and behavior. One mediator of this process may be due to *changes in Bdnf gene activity by way of the brain-derived neurotrophic factor Bdn protein*<sup>42</sup>.

Rachel Yehuda, Professor of Psychiatry and Neuroscience at the Mount Sinai School of Medicine, New York has undertaken to study the children of Holocaust survivors. She found that they were three times more likely to develop post-traumatic stress disorder when they were exposed to a traumatic event than demographically similar Jewish persons whose parents perished in the Holocaust. Furthermore, these children exhibited the same neuroendocrine (hormonal) abnormalities that were observed in Holocaust survivors and persons with post-traumatic stress disorder<sup>43</sup>.

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*Holocaust survivors: Leaders' reactions.* American Journal of Orthopsychiatry, 50(1), 96.

<sup>42</sup> Branchi I, Francia N, Alleva E. (2004). *Epigenetic control of neurobehavioral plasticity: the role of neurotrophins.* Behavioral Pharmacology. 2004; 15:353–362.

<sup>43</sup> See the following works of

1. Sorscher, N., and Cohen, L. J. (1997). *Trauma in children of Holocaust survivors: Transgenerational effects.* American Journal of Orthopsychiatry, 67(3), 493;
2. Yehuda, R., Halligan, S. L., and Grossman, R. (2001). *Childhood trauma and risk for PTSD: relationship to intergenerational effects of trauma, parental PTSD, and cortisol excretion.* Development and psychopathology, 13(3), 733-753;
3. Yehuda, Rachel; Daskalakis, Nikolaos P.; Binder, Elisabeth B. et al. (2016). *Holocaust Exposure Induced Intergenerational Effects on FKBP5 Methylation.* Biological Psychiatry, 80 (5): 372;

Following 9/11 Yehuda and her colleagues performed a longitudinal study on 38 women who were pregnant on 9/11 and were either at or near the World Trade Center at the time of the attack<sup>44</sup>. The children of women who were traumatized as a result of 9/11 subsequently exhibited an increased distress response when shown novel stimuli. Again, this was related to the stage of pregnancy – those with the largest distress response were the ones born to mothers who were in their second or third trimester when exposed to the World Trade Center attacks<sup>45</sup>.

Yehuda is currently trying to identify genetic variations and epigenetic markers associated with PTSD in combat veterans. Yehuda's work establishes low cortisol levels as a risk factor for developing PTSD and, when taken together with the animal studies, suggests that traumatic experiences can leave epigenetic marks that alter the stress response in offspring<sup>46</sup>.

Katharina Gapp from the University of Zurich 'traumatized' male mice by separating them from their mothers at unpredictable times in the first two weeks of life. When these young mice became adults, they were more hesitant to enter open spaces and brightly lit areas than mice that had not been separated from their mothers. If they were people, we would diagnose them as neurotic. *These behavioral changes were present in the mice's offspring, which also displayed alterations in metabolism, and in their offspring's offspring*<sup>47</sup>.

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<sup>44</sup> Yehuda, R., et al (2005). *Transgenerational Effects of Posttraumatic Stress Disorder in Babies of Mothers Exposed to the World Trade Center Attacks during Pregnancy*. Journal of Clinical Endocrinology and Metabolism.

<sup>45</sup> Sarapas, C et al (2011). *Genetic markers for PTSD risk and resilience among survivors of the World Trade Center attacks*. Disease Markers

<sup>46</sup> Yehuda, R., Lehrner, A., and Peters Bronx, J. J. (2018). *Intergenerational transmission of trauma effects: putative role of epigenetic mechanisms*. World Psychiatry, 17(3): 243–257.

Yehuda, Rachel, Daskalakis, Nikolaos P., Desarnaud, Frank et al., (2013). *Epigenetic biomarkers as predictors and correlates of symptom improvement following psychotherapy in combat veterans with PTSD*. Front. Psychiatry,

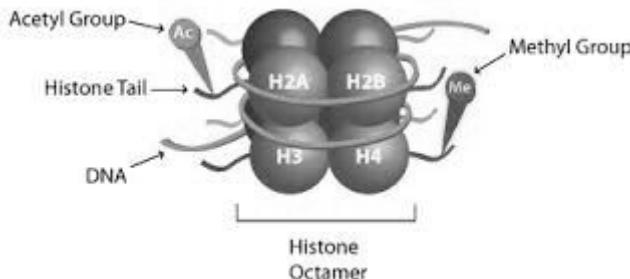
<sup>47</sup> See the following papers:

1. Gapp, Katharina, Jawaid, Ali, Sarkies, Peter, Mansuy, Isabelle M et al., (2014).

### *Birthing and Parenting at Times of Crisis*

**"We were able to demonstrate for the first time that traumatic experiences affect metabolism in the long-term and that these changes are hereditary,"** said Professor Isabelle Mansuy, who led the study. There is much discussion among geneticist as to how epigenetic changes are passed on through sperm. Remember a few pages back the study of males who smoked or ingested marijuana compared to a control group with no such exposures? The researchers showed genetic changes in the sperm of animals exposed to cannabis. Now scientists are discovering that the classical genetic code is not the only code involved in the regulation of cell differentiation and behavior in multicellular organisms.

There is a second level of control that contributes to the regulation of patterns of gene expression. One of these is based on chemical modifications of the histone proteins. Histones are part of the content of sperm transmitted at fertilization. Histones are distinct from DNA, although they combine with it during cell formation, acting a bit like a spool around which the DNA winds (Fig. 10).



**Fig. 10.** Histone

Credit: EpiGentek

Researchers from the U of CA, Santa Cruz and U of IN, Bloomington created mice in which they slightly altered the biochemical information on the histones during sperm cell formation. What they discovered was that there were dire consequences for the offspring both in terms of

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*Implication of sperm RNAs in transgenerational inheritance of the effects of early trauma in mice.* Nature Neuroscience 17, 667–669

2. Gapp, Katharina; Bohacek, Johannes; Mansuy, Isabelle M et al. (2016). *Potential of Environmental Enrichment to Prevent Transgenerational Effects of Paternal Trauma.* Neuropsychopharmacology.

their development, and in terms of their survival<sup>48</sup>.

Another proposed mechanism involves small non-coding RNAs called micro RNAs (miRNAs) found in many mammalian cell types including sperm. miRNAs appear to target about 60 per cent of the genes of humans and other mammals. miRNAs constitute a newly appreciated type of gene regulator, where each miRNA controls a distinct set of genes. Sperm miRNA expression in humans is known to be affected by environmental factors, such as smoking and obesity.

Male subjects in the study were given the Adverse Childhood Experiences (ACE) questionnaire which reveals the degree of abusive and/or dysfunctional family experiences when young. Men with most abuse had a 300 times greater reduction in two sperm miRNAs compared to men with the least abuse.

A high ACE score increases risks of developing future psychological and physical disorders. These miRNAs turn off the function of specific target genes, potentially causing long-lasting changes in gene expression. Sperm miRNA expression in humans is known to be affected by environmental factors, such as smoking and obesity.

To see whether these alterations could be responsible for the abnormal behavior in the next generation, the scientists isolated RNA from the sperm of traumatized mice and injected it into an ovum that had already been fertilized, excluding any effects due to changes to the DNA of the sperm. They found that the resulting mice developed the same behavioral and metabolic abnormalities as the natural offspring of the traumatized mice, suggesting that these effects were transmitted through miRNA in the sperm.

The idea that these changes can influence the next generation is supported by additional findings in the study, e.g.: the same sperm miRNA changes that take place in men with high ACE scores also occur

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<sup>48</sup> Gaydos, L. J., Wang, W., and Strome, S. (2014). *H3K27me and PRC2 transmit a memory of repression across generations and during development*. Science, 345(6203), 1515-1518.

### *Birthing and Parenting at Times of Crisis*

in mice exposed to early life social stress. Similar changes were also observed in the hippocampus (the area of the brain thought to be the center of emotion, memory, and the autonomic nervous system) in their offspring<sup>49</sup>.

Looking to the future, we may be able to determine a way to restore the low miRNA levels found in men exposed to extreme trauma, because epigenetic changes, such as stress-induced decreases in sperm miRNA expression, are reversible. For example, obesity has been shown to alter specific sperm miRNA levels in men, while bariatric surgery and subsequent weight loss can reverse the changes.

Tracy Bale and her colleagues at the University of Maryland School of Medicine have unravelled new details about these miRNA changes<sup>50</sup>. In the male reproductive tract, the *caput epididymis*, the structure where sperm matures, releases tiny vesicles packed with microRNAs that can fuse with sperm to change its payload delivered to the egg. The caput epididymis responds to the father's stress by altering the content of these vesicles. Extracellular vesicles help pass information between cells and onto offspring. Their cargo can carry molecular signals, signs of disease, and even effects of stress<sup>51</sup>. In an important departure from past assumptions, Bale states, "***The reproductive biologists have now accepted the fact that sperm can be vulnerable to the environment.***"<sup>52</sup>.

In addition to miRNAs there also exist long non-coding RNAs (lncRNAs). They appear to be derived from ancestral genes. Their genetic sequence is in some cases similar to that of the ancient genes, but they have lost

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<sup>49</sup> Gapp, Katharina, Jawaid, Ali, Sarkies, Peter, Mansuy, Isabelle M et al., (2014). *Implication of sperm RNAs in transgenerational inheritance of the effects of early trauma in mice*. Nature Neuroscience 17, 667–669.

<sup>50</sup> Morgan, Christopher P. and Bale Tracy L. (2011). *Early prenatal stress epigenetically programs dysmasculinization in second-generation offspring via the paternal lineage*. J Neurosci. 17; 31(33): 11748–11755.

<sup>51</sup> Chan, J. C., Morgan, C. P., Rodgers, A. B. et al. (2020). *Reproductive tract extracellular vesicles are sufficient to transmit intergenerational stress and program neurodevelopment*. Nature Communications, 11(1), 1-13.

<sup>52</sup> Bale, Tracy (2018). University of California, Santa Cruz, SciCom Interview. Retrieved from <https://scicom.ucsc.edu/publications/QandA/2018/bale.htm>

Change

their protein-coding abilities. They may represent remnants of protein-coding genes that transitioned into lncRNAs. In recent years, lncRNAs were found to be important for the activation or repression of genes relevant to a variety of disorders<sup>53</sup>.

In view of the above cited research – which does not claim to be exhaustive but rather representative of the field – there is robust and convincing biological evidence of transgenerational transmission of stress and trauma by both parents. Probable mechanisms include: the programming of the HPA axis during pregnancy and **epigenetic changes in maternal and paternal germ cells**.

Rachel Yehuda is the first researcher to have demonstrated that treatment response to psychotherapy in veterans is associated with an epigenetic alteration. The data suggest that **psychotherapy constitutes a form of “environmental regulation” that substantially improves the well-being of patients by altering their epigenetic state**.

A new study by Katharina Gapp seems to support Yehuda's findings. It has shown that behaviors caused by traumatic experiences in early life are reversible. Researchers found that environmental enrichment, allows trauma-related symptoms, at least in mice, to be reversed. The symptoms and their reversal were associated with epigenetic modification of the glucocorticoid receptor gene. The thinking is that a similar process takes place in psychotherapy, particularly if it involves a prolonged therapeutic relationship<sup>54</sup>.

## 2. Social Epigenetics

Using mice as a model to study human breast cancer, researchers have demonstrated that a negative social environment (in this case, isolation)

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<sup>53</sup> Hezroni, Hadas, Perry, Rotem ,Ben-Tov, Ulitsky, Igor et al.,(2017). A subset of conserved mammalian long non-coding RNAs are fossils of ancestral protein-coding genes. *Genome Biology*; 18 (1)

<sup>54</sup> Gapp, Katharina; Bohacek, Johannes; Mansuy, Isabelle M et al. (2016). *Potential of Environmental Enrichment to Prevent Transgenerational Effects of Paternal Trauma*. *Neuropsychopharmacology*.

### *Birthing and Parenting at Times of Crisis*

causes increased tumor growth. The findings also support previous epidemiologic studies suggesting that social isolation increases the mortality of patients suffering of chronic diseases, as well as clinical studies revealing that social support improves the outcomes of cancer patients. **The presence of compassionate and caring people can alter the level of gene expression in a wide variety of tissues including the brain<sup>55</sup>.**

One of the most creative experiments that I have encountered in my professional life, is the “Kidnapping-and-Cross-Fostering Study” created by Gene Robinson, Director, Institute of Genomic Biology, University of Illinois. What Robinson did was to pluck about 250 of the youngest bees from two African hives (“killer bees”) and two European hives (*a gentle bee strain*), and paint marks on the bees’ backs to identify their origins. Then, he and his team switched each set of newborns and put them into the hive of the other subspecies<sup>56</sup>. European honeybees raised among more aggressive African bees, not only became as belligerent as their new hive mates – they came to genetically resemble them. And vice versa. What this experiment beautifully proves is that **the social environment can change gene expression and behavior<sup>57</sup>.**

There is simply no doubt that social interactions play a crucial role in all aspects of child development. Research from The Salk Institute for Biological Studies, La Jolla, CA supports this in the area of language acquisition. The scientists studied young zebra finches. They compared socially tutored birds with passively tutored birds. The infant birds paid more attention to songs that tutors directed at them as opposed to tutors that did not. As we have seen, some animal parents are better caretakers of their offspring than others. Furthermore, adult finches just

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<sup>55</sup> Conzen, Suzanne (2009). *Social isolation worsens cancer*. Institute for Genomics and Systems Biology. Retrieved from: <http://www.igsb.org/news/igsb-fellow-suzanne-d-conzen-social-isolation-in-mice-worsens-breast-cancer>

<sup>56</sup> Concerning ‘Bias’

Two African hives (“killer bees”) and two European hives (*a gentle bee strain*). Please, I am not trying to offend anyone here. The study is about bees not people.

<sup>57</sup> Zayed, Amro and Robinson, Gene E. (2012). *Understanding the Relationship Between Brain Gene Expression and Social Behavior: Lessons from the Honey Bee*. Annu. Rev. Genet. 46:591–615.

like we humans, change the structure of their vocalizations when addressing their young from the way they interact with adults of their own age. The experiment also showed that social interactions that enhanced learning increased the activity of noradrenergic and dopaminergic midbrain neurons<sup>58</sup>. The following study went a step further, and examined what effect social interactions have at the genetic level.

David Clayton<sup>59</sup>, a neurobiologist and a colleague of Gene Robinson, at the University of Illinois, found that if a male zebra finch heard another male zebra finch sing nearby, a particular gene in the bird's forebrain would be stimulated and it would do so differently depending on whether the other finch was strange and threatening, or familiar and safe. Songbirds demonstrated massive, widespread changes in gene expression in just 15 minutes. We are learning that brain responses to social stimuli can be massive, involving hundreds, some-times thousands of genes. Even as recently as 20 years ago no self-respecting geneticist or neuroscientist would have thought in their wildest dreams that social experiences lead to changes in brain gene expression and behavior<sup>60</sup>.

### 3. Personal Epigenetics

**For a long time, we have known that the mind affects the body and conversely, the body affects the mind.** For example, people under stress are more likely to become ill and people who suffer of the flu or other health issues often feel blue or even depressed. In medical parlance this

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<sup>58</sup> Doya, Kenji and Sejnowski, Terrencej (1999) *A Computational Model of Avian Song Learning* in Gazzaniga, Michael S. (1999). *The New Cognitive Neurosciences*, MIT Press, Cambridge, MA.

<sup>59</sup> Clayton, DF, London SE (2014). *Advancing avian behavioral neuroendocrinology through genomics*. Frontiers in Neuroendocrinology vol. 35, (1) 58-71.

<sup>60</sup> Chena, Yining; Mathesonb, Laura E.; and Sakataa, Jon T. (2016). *Mechanisms underlying the social enhancement of vocal learning in songbirds*. PNAS, published ahead of print May 31, 2016, doi:10.1073/pnas.1522306113. Edited by Thomas D. Albright, The Salk Institute for Biological Studies, La Jolla, CA.

*Birthing and Parenting at Times of Crisis*

reciprocal process has been referred to as psychosomatic medicine. Now a new study by Harvard researchers reveals the biological mechanism underlying such effects.

The researchers divided 84 hotel maids into two groups. One group was told that the work they do is good exercise and satisfies the Surgeon General's recommendations for an active lifestyle. The other group (control) was not given this information. Although actual behavior did not change, four weeks after the start of the experiment, the informed group perceived themselves as getting significantly more exercise than before. Compared to the control group, they showed a decrease in weight, blood pressure, body fat, waist-to-hip ratio, and body mass index. **"It wasn't that they started working harder. Their bodies actually changed their functioning in response to changed perceptions"**<sup>61</sup>.

Leading scientists at Stanford University Medical Center have recently demonstrated that changed perceptions of the self can be quite easily produced, at least for a time, by hypnosis as David Spiegel, professor and associate chair of psychiatry and behavioral sciences at Stanford is quoted as saying, **"Hypnosis is the oldest Western form of psychotherapy, but it's been tarred with the brush of dangling watches and purple capes."** Spiegel and his colleagues scanned the brains of 57 subjects using functional magnetic resonance imaging (MRI), which measures brain activity by detecting changes in blood flow. Each person was scanned under four different conditions – while resting, while recalling a memory and during two different hypnotic sessions. During hypnosis the researchers observed actual changes in three brain areas that regulate focused attention, enhanced control of the body and one's emotions, and lack of self-consciousness<sup>62</sup>.

Now consider the wide spread practice of meditation. According to a study undertaken at Richard Davidson's laboratory in Wisconsin, in collaboration with the Spanish geneticist Perla Kaliman, meditating for

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<sup>61</sup> Crum, Alia J. and Langer, Ellen J (2007). *Mind-Set Matters: Exercise and the Placebo Effect*. Psych Sc Volume 18—Number 2, 165-171

<sup>62</sup> Jiang, Heidi; White, Matthew P.; Spiegel, David et al. (2016). *Brain Activity and Functional Connectivity Associated with Hypnosis*. Cerebral Cortex.

eight hours on mindfulness, altruistic love, and compassion induces major epigenetic modifications. Compared to a control group whose members did not meditate but engaged in leisure activities in the same environment, the researchers found in the meditators reduced expression of *histone deacetylase genes*, alterations in global modification of histones and decreased expression of pro-inflammatory genes. Translation: people who meditated were more resilient to infections and diseases in general than the control group. “**We can glimpse here the possibility of an epigenetic transformation of a person by way of self-regulation rather than the environment,**” said Perla Kaliman, the lead investigator<sup>63</sup>.

## The Good News

According to a new study from the University of Helsinki listening to Mozart’s violin concerto No. 3, G-major, that lasts 20 minutes, amplified the activity of genes involved in dopamine secretion and transport, synaptic neurotransmission, learning and memory, and down-regulated the genes mediating the destruction of neurons, which is all for the good. Unfortunately, for those not inclined to listen to classical music, **“the effect was only detectable in musically experienced participants, suggesting the importance of familiarity and experience in mediating music-induced effects”**<sup>64</sup>.

How we live our lives can have significant effects on how we stay healthy, how we age and develop diseases including cancer. Take colon cancer, for example. Researchers from the University of Basel found that aspirin and hormonal replacement therapy reduced the methylation rate of colon cancer related genes, whereas smoking and high Body Mass Index (BMI) increased it. They concluded, **“Lifestyle, including aspirin use, modulates age-associated DNA methylation change in the**

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<sup>63</sup> Kaliman, Perla; Alvarez-Lopez , Maria Jesus; Davidson, Richard J. et al., (2014). *Rapid changes in histone deacetylases and inflammatory gene expression in expert meditators.* Psychoneuroendocrinology, 40, 96–107

<sup>64</sup> Kanduri, Chakravarthi; Raijas, Pirre; Järvelä, Irma (2015). *The effect of listening to music on human transcriptome.* PeerJ, 23: e830

*Birthing and Parenting at Times of Crisis*  
**colonic epithelium and thereby impacts the evolution of cancer methylomes**<sup>65</sup>.

Steve Cole<sup>66</sup>, Professor of Medicine, Psychiatry and Biobehavioral Sciences UCLA School of Medicine, has written much on the subject of self-regulation. He holds, and I totally agree with him, that **we are architects of our own lives more than we realize**. Our subjective experience carries more power than our objective situation. If I feel less smart or less attractive than the person next to me, I'm going to live a very unhappy life. If I feel appreciated and respected even though there's nobody around me; if I come at the world with a sense that I'm fine just the way I am, then my body is going to act as if I'm okay - even if I'm totally wrong about all that. Epigenetics does that. It underscores the fact that DNA alone is not our destiny.

## To Sum Up The Changes

In the 1850s, when Darwin first put forth his theory of natural selection and survival of the fittest the underlying molecular mechanisms of genetics were unknown. However, over the past 50 years, advances in genetics and molecular biology have led to a neo-Darwinian theory of evolution based on epigenetics.

Our survey of recent discoveries in epigenetics has made it abundantly clear how nature (genes) and nurture (the environment) work in concert. It is not one or the other that is responsible for a disease or personality trait. The only thing we know for sure is that **we are the product of a dynamic interaction between these forces and that nothing about us is written in stone**. Therefore, as long as we breathe, **we are a work in progress, constantly changing**. Epigenetic modifications are dynamic and potentially reversible processes that take place over our entire lifetime.

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<sup>65</sup> Noreen, Faiza; Röösli, Martin; Gaj, Paweł et al. (2014). *Modulation of Age- and Cancer-Associated DNA Methylation Change in the Healthy Colon by Aspirin and Lifestyle*. Journal of the National Cancer Institute 07/2014; 106(7).

<sup>66</sup> Cole, Steve W. (2009). *Social Regulation of Human Gene Expression*. Current Directions in Psychological Science; vol. 18, 3: pp. 132-137.

A massive amount of basic and clinical research at leading universities indicates that before their offspring is even conceived, a parent's life experiences such as with food, drugs, exposure to toxic products and stress can affect the development and health not only of their children, but even of their grandchildren. Thus, an epigenetic hypothesis for environmental contributions to health continues to gain traction<sup>67</sup>.

In addition, there is now converging evidence that clearly shows that our social lives, our interactions with others and ourselves can change our gene expression with a rapidity, breadth, and depth previously unknown. Genes don't make us who we are. Gene expression does. And gene expression varies depending on the life we live. In other words, the food we eat, the water we drink, the air we breathe, our interpersonal relationships, our relationship to ourselves – they all matter.

## Key Take Aways

An individual's adult physical and mental health is heavily influenced by early prenatal environmental factors affecting the mother.

The unborn child will adjust as best it can to the external environment they are going to encounter upon birth by way of epigenetic changes.

<sup>67</sup> see the following papers:

1. Costa E, Chen Y, Dong E, Grayson DR, Kundakovic M, Guidotti A. (2009). *GABAergic promoter hypermethylation as a model to study the neurochemistry of schizophrenia vulnerability*. Expert Review of Neurotherapeutics. 9:87– 98.
2. McGowan, P.O., Meaney M.J., Szyf M. (2008). *Diet and the epigenetic (re)programming of phenotypic differences in behavior*. Brain Research, 1237: 12-24;
3. McGowan PO, Szyf M. (2010). *The epigenetics of social adversity in early life: Implications for mental health outcomes*. Neurobiology of Disease. 39(1), 66-72;
4. Roth TL, Lubin FD, Sodhi M, Kleinman JE (2009). *Epigenetic mechanisms in schizophrenia*. Biochimica et Biophysica Acta (BBA) - General Subjects; 1790:869– 877;

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During each life cycle, germ cells preserve and pass on both genetic and epigenetic information.

Traumatic experiences of parents lead to extra-sensitivity to traumatic events in offspring, and this may persist for several generations.

Gene activity accelerates or decelerates in response to changes in our environment.

If you want to have healthy children, live healthy.



## EPILOGUE

### Our World Vision

by Anika Marjadi

I am having this wide smile  
As I have covered a mile of writing  
Different views of this Earth  
Pandemic causing worry and mirth.

I am hopeful as I see light ahead of this virus tunnel  
The path looks dark  
but when lit with our energy  
can bring across a wonderful magic.

Each time I alter an angle in my kaleidoscope  
I see wonders and dreams full of hopes.  
I see lessons learnt and realized  
I see healings and visions.

When running the rat race of life  
We all needed this pause  
This pause to change  
This pause to understand  
This pause to ponder



This pause to correct  
This pause to suggest  
This pause to breathe  
    This pause to live  
    This pause to know  
    This pause to show.

That life is in the moment no money can buy  
Just enjoy this time and don't sulk and cry.

We all can give our best to make a change  
We all can be our best to bring this change.

A change that can change the face of humanity  
    From cruel to compassionate  
        From evil to love  
    From mean to lets lean  
    From ambition to emotion  
        From mine to ours  
        From war to peace  
    From greed to sowing the happiness seed  
        From quarrels to morals  
        From attitude to gratitude.

If we all are in this together  
Nothing can affect no matter  
Make humanity our religion.

Let's make this our world Vision!

Our primal journey  
from before conception  
to birth and beyond  
can be a challenging but...  
victorious adventure.

Working with your primal adversities  
or what we have labelled as adversities  
provides the extra resources which can  
support us at times most needed.

You are ready for this moment change!

## *About the Editors and Authors*



Jon RG Turner & Troya GN Turner-Groot (co-Editors, introduction)

The Turners are Pioneers in Prebirth Psychology since 1970. They are co-founders of the Whole-Self Discovery and Development Institute Inc. International and they have more than 50 years of Pioneering Research and Practice in Whole-Self Prebirth Psychology, Philosophy & Education teaching and training Holistic Prebirth & Birth Psychology Education to over 20,000 People in over 30 countries around the globe. They have over 100 papers & articles in magazines, specialist & medical publications. They are Editors-in-Chief of the *International Journal of Prenatal & Life Sciences* and books *Prenatal Psychology, 100 Years* (2018) and *Whole-Self Approaches in Prebirth Psychology & Medicine* (2020). In 2007, they received a Distinguished Award of Excellence from the Global Foundation for Integrative Medicine and in 2012, they received the ISPPM Elda Mazzocchi Scarzella Award. They are life-long honorary members of ISPPM.

<https://wholeselfprebirthpsychology.wordpress.com/>

Whole-Self.org & Whole-Self.info email: whole-self@quicknet.nl

**Olga Gouni (co-Editor, chapters 1,2)**

Olga is a researcher, a Whole-Self Prenatal Psychotherapist/ Educator. She is the founder of cosmoanelixis, the organization that offers Postgraduate and Specialization Professional Education in Prenatal and Life Sciences

education globally. She is member of the Research Team COST Action and founder of the International Journal of Prenatal & Life Sciences Academic, open access journal and a founding member of the Prenatal Sciences Research Institute SOPHIA. She has designed the Health Advancement program WELCOME to work with pregnant couples focusing on the wellbeing of the unborn child. Her main interest is connecting the Academic world with the community designing and implementing services that promote human consciousness evolution, wellbeing and peace.

<https://www.cosmoanelixis.gr>, <https://www.prenatalpsychology.org>  
<https://www.journalprenatalife.com>, email: info@cosmoanelixis.gr

**Mirjana Sovilji (chapter 2)**

Prof. Mirjana Sovilji is psycho-physiologist, audiolinguist, valeologist and prenatal psychologist. She has PhD in psychophysiology and a Honorary PhD in philosophy of valeology, IABET. She is the Restorer and Director of the Institute for Experimental Phonetics and Speech Pathology, "Đorđe Kostić", and co-founder

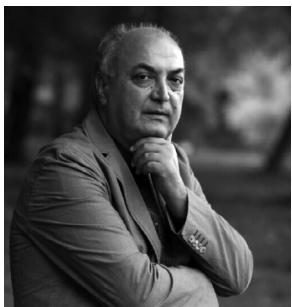
of Life Activities Advancement Institute in Belgrade. Her publications are a reflection of her holistic approach in studying and research of speech and language through different scientific aspects and her studies belong to different scientific domains including: psycholinguistics, pedagogy, developmental psychology, applied linguistics, electro acoustics, neural linguistics, electrophysiology, prenatal medicine, audio linguistics, philosophy of language, valeology, cosmogony etc



## Emilia Radmilović (chapter 2)

Emilia Radmilovic was born in Nish, Serbia, in 1965. She works in the Public Library "Stevan Sremac", Nish, Periodicals Department. Her love and devoted engagement in the world of books, rank her high in reading expanding programs that support knowledge dissemination in different populations. She is the founder

and editor of the library magazine "Bibliozona" (year of establishment 2010). She appears on the TV and radio programs and she has been the host of numerous cultural events. Since 1985 she has been actively involved in choral singing and she is one of the board members of the Church Choir "Branko", Nish. Emilia is the enthusiastic soul behind the International festival of spiritual music "Musical edict".



## Dejan Rakovic (chapter 3)

Professor Dejan Rakovic has wide scientific interests, broadly related to materials science and biophysics, covering the fields of nanomaterials & biomaterials, nanotechnology and spectroscopy, as well as biophysics and bioinformatics of biomolecular, psychosomatic, cognitive and electrophysiological functions. He has

published over 250 scientific papers and communications, cited over 400 times in scientific periodicals and monographs, and has given numerous invited lectures in former Yugoslavia and abroad. From 1997 to now he is the vice-president of the Yugoslav Materials Research Society. During the period 1995-1998 he headed regional project Brain and Consciousness at the European Centre for Peace and Development (ECPD) of the United Nations University of Peace in Belgrade. In 2009 he founded his Fund (DRF) for Holistic Research and Ecology of Consciousness, with wide promotive holistic activities. In 2015 he co-organized the 1st Int. Congress on Psychological Trauma: Prenatal, Perinatal & Postnatal Aspects. Prof. Rakovic is Serbia Co-Director of the Whole-Self Discovery & Development Institute International.



### Elizabetha Levin (chapter 4)

Elizabetha studied at Kiev's Polytechnic Institute majoring the physics of metals. In 1974 she repatriated to Israel, studied physics at the Technion (Israel Institute of Technology) and holography at the Weizmann Institute of Science. She earned her Bachelor's of Arts in physics in 1977; and then a Master's degree and a Doctorate of Science in material sciences and engineering at the Technion, where she also taught undergraduate students. From 1983 to 1991 she was a member of the Center for

the Study and Research of Modes of Consciousness (Haifa) and she developed a new approach to time-studies. One of her dreams is to make it clear that before making revolutions and blaming the Universe for our suffering, people are invited to learn how to conceive and deliver our children in love. Elizabetha is Israel Co-Director of the Whole-Self Discovery & Development Institute International.

<http://celestialtwins.wix.com/elizabetha-levin>



### Claire Zerafa (chapter 5)

Claire Zerafa is a Perinatal Mental health midwife. She graduated as a midwife in 1995 and she further obtained a Master's Degree in Bioethics from the University of Malta with a dissertation entitled *Maternal and Neonatal Health in times of disaster*. She is currently reading for a 2nd Master degree in Perinatal Mental Health with the University of Sheffield. She is a visiting lecturer and a mentor with the department of midwifery at the University of Malta. Her passion is to raise awareness about mental

health and is a co-founder of the NGO *Parent Infant Mental Health Alliance Malta* she also represents midwives in the Malta Union of Midwives and Nurses.



## Calleja-Agius Jean (chapter 5)

Professor Jean Calleja-Agius graduated as a Doctor of Medicine and Surgery from the University of Malta in 1999. She further specialised in Obstetrics and Gynecology, and is a Fellow of the Royal College of Obstetricians and Gynaecologists (UK) and of the Royal College of Physicians of Ireland. She is currently Head of the Department of Anatomy at the Faculty of Medicine and Surgery at the University of Malta, where she lectures to medical students, post-graduate trainees and other health professionals. She has numerous peer reviewed research articles published in international high impact journals. Both her PhD and her research interests revolve around women's health and reproductive medicine.



## Rev Raymond Zammit (chapter 5)

Rev. Dr Raymond Zammit holds a Doctorate in Ethics with a specialization in Bioethics and currently chairs the Professional Ethics Platform at the Faculty of Theology at the University of Malta. He delivers a number of courses on social and professional ethics in bioethics, business, criminal justice, and food. A member of Malta's national Bioethics Consultative Committee between 2008-2013, he also participated in COST Action IS1201 Disaster Bioethics (European Cooperation in Science and Technology). He is currently a member of the Health Ethics Committee of the Department of Health (Malta) as well as a member of the Bioethics Reflection Group of COMECE.



## Ankita Marjadi (chapter 6, epilogue, poem)

Dr. Ankita Marjadi is a professional Homoeopath, Psychotherapist, Certified Child Birth Educator and Author of the book "Knock Knock Let's Talk". For a decade now she has been practicing Homoeopathy along with psychotherapy since a decade now and is researching

on the efficacy of both when applied together for mental health. Her book *Knock Knock Let's Talk* was an effort to add positivity during pregnancy and make pregnancy a very soulful journey. She has been working to bringing a change in the journey of expecting parents by adding the virtues propagated in the book thereby making a prenatal bond with the baby in the womb. She has been a social activist wherein she works on the causes of spreading awareness about menstrual hygiene, good touch bad touch and has been working closely with many underprivileged children giving them and their families free medical help. She is also a doting mother of two beautiful rainbow babies.



## Thomas R. Verny (chapter 7)

Thomas R. Verny, MD, DPsych., DHL, FRCPC, FAPA is a psychiatrist, writer and academic. He has previously taught at Harvard University, University of Toronto, York University, Toronto, St. Mary's University, Minneapolis, Minnesota

and the Santa Barbara Graduate Institute.. In 1981, Dr. Verny published the landmark book *The Secret Life of the Unborn Child*. In 1983, he founded the Pre- and Perinatal Psychology Association of North America (PPPANA, renamed APPPAH in 1995), and served as its president for eight years. In 1986, he launched the Association's Journal (Human Sciences Press, New York), which he edited from its inception until 1990. In 2013, he became once again Editor-In-Chief of the Journal (JAPPPAH).

### *Birthing and Parenting at Times of Crisis*

Verny's many books, professional publications and teachings have established him as one of the world's leading authorities on the effect of the prenatal and early postnatal environment on personality development. In 2004 *Mothering Magazine*, in recognition of Verny's contributions to the field of parenting and child rearing, named him one of their "living treasures." In 2005, the Santa Barbara Graduate Institute bestowed on Verny a Doctorate of Humane Letters (DHL). Dr. Verny retired from active practice in 2014. He lives with his wife in Stratford, Canada. He is Associate Editor of *the Journal of Pre and Perinatal Psychology Association and Health (JOPPPAH)*, member of the Ontario Review Board (ORB) and Editor Emeritus for *The International Journal of Prenatal & Life Sciences*. <http://www.trvernymd.com>

### Akira Ikegawa (chapter 8)



Dr. Akira Ikegawa is a highly respected and compassionate healthcare professional with more than 40 years of medical and academic experience. Extensive background in the research of the Prenatal Memory. Delivering lectures and presentations nationally and internationally about the extraordinary concept of Prenatal Memory, Holistic Childbirth Education, and Conscious Parenting to bring a harmonious lifestyle for all human beings. He is aiming toward restoring self-esteem so that international citizens on this planet will be able to build the society which is collectively compassionate towards one another.

### Antonella Sansone (chapter 9)



Antonella is a mother, clinical psychologist, PhD candidate, mindfulness teacher/facilitator and author. She has a special interest in the impact of the pre/perinatal period on human development and mental health, integration of primal wisdom and

Change

science, psychosomatics, and mind-body approaches to health-enhancement, prevention and healing. Sansone's work with expectant and new parents and infants in UK and Italy, empirical studies of African indigenous cultures, and inspiring motherhood have led to the writing of her third book *Cultivating Mindfulness to Raise Children Who Thrive: Why Human Connection from Before Birth Matters* (Routledge, 2020) and the design of a PhD drawing on it. She has been granted the *International Excellence Award* from Central Queensland University in Australia. Her PhD explores associations among maternal mindfulness, mental health, and mother-fetus relationship, and mother-infant relationship, in particular emotional availability. She has developed the Prenatal Mindfulness Relationship-Based (PMRB) program focused on mother-fetus interactions and aimed at promoting human connection prior and after birth, and mitigating the risk of postnatal depression, anxiety, and stress. Sansone has been involved in the World Association of Infant Mental Health (WAIMH), Marce' Society for Perinatal Mental Health and its Australasian chapter, APPPAH and ISPPM for several years and has presented at their international congresses.



### Blazy Helga (chapter 10)

Helga Blazy PhD, studied psychology, Malay, Indonesian and Indian languages and cultures and general linguistics. She has been an active member of ISPPM since 1989. Many of her papers on Indonesian pregnancy and childbirth in literature, phantasy, and reality have been published in the ISPPM-Journal. In 1995 she (together with Ursula Kassler) translated the important work done by

Joanna Wilheim from Portuguese into German. She has been teaching prenatal psychology since 1995 in Cologne and since 2008 she has been training professionals on Bonding Analysis. Helga has had an extensive book editing work on Bonding Analysis and Prenatal Psychology. She has her own practice in child and adult therapy and she does Bonding Analysis with pregnant mothers and couples. She also organizes BA training groups in Cologne and Warsaw.

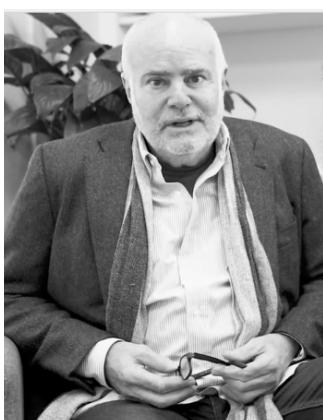


### Klaus Evertz (chapter 11)

Klaus Evertz with a background in Philosophy and Art is a Visual artist, art therapist (BKMT/FEAT), psychotherapist (HPG), art analyst and the founder of the "Institute for Art Therapy and Art Analysis Cologne". Since 1984, he works with tumor patients at the

University Clinic Cologne, especially in the palliative clinic; In 1990, he developed the "Analytical-Aesthetic Art Therapy", an artistically and depth psychologically oriented form of art therapy, and the "Psycho-oncological Art Therapy and since 1993 he has been a lecturer in psycho-oncological art therapy at the Mildred-Scheel-Akademie, Deutsche Krebshilfe eV, University Clinic Cologne. He is a member of the DGP (German Society for Palliative Medicine), ISPPM (International Society of Pre- and Perinatal Psychology and Medicine (Board 2005-2010) and BKMT (Federal Association for Art, Music and Dance Therapy). He teaches at the Universities of Cologne and Dresden, the Nürtingen University of Art Therapy and the Nürtingen-Geislingen University of Economics and Environment.

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### Karlton Terry (chapter 12)

Karlton Terry is an IPPE Certified Principal Teacher and the Co-Founder of the IPPE - Institute for Pre and Perinatal Education. Initially a businessman, he soon started to explore the territory in the deeper realms of psychology and psychotherapy: holotropic breathwork, body psychotherapy, primal therapy, and eventually, Pre and Perinatal Psychology through the work of Margaret

Grant, Graham Farrant, and William Emerson. He taught courses with William Emerson in Europe and in Mexico and he began developing his own courses. He developed a busy private practice devoting himself to teaching, working with babies, writing and training teachers and therapists how to work with babies.



### Appleton Matthew (chapter 13)

Matthew Appleton is a registered Craniosacral Therapist and Body Psychotherapist living and working in Bristol, England. In 2006, he founded *Conscious Embodiment Trainings* to facilitate Prenatal and Birth Workshops for adults and teach Integrative Baby Therapy to health professionals. For ten years he worked as a houseparent at A. S. Neill's famous democratic school Summerhill and his book 'A Free Range

Childhood' based on his experiences at Summerhill has been published in several languages. His latest book *Transitions to Wholeness* provides an excellent overview of his philosophy and practice.

He can be contacted at matthew.appleton@sky.com



### Ludwig Janus (chapter 14)

Ludwig Janus, M.D. is a lecturer and psychoanalysis instructor at the Psychoanalytic Training Institute in Heidelberg, Germany. He is past-president of the International Society for Prenatal and Perinatal Psychology and Medicine (ISPPM) and acts as an Advisory Emeritus for the International

Journal of Prenatal & Life Sciences. He is also the co-founder of the Institute for Prenatal Psychology and Medicine. He has published numerous articles and books on prenatal and perinatal psychology and on psychohistory, including *The Enduring Effects of Prenatal Life*.

<http://www.ludwig-janus.de>



**Brigitte Johanna Winkler (poem)**

Brigitte Johanna Winkler has many years of experience in the field of Natural healing methods among which Reflexology, Metamorphic Technique, Bowtech, and Counseling for stress release and Self-Improvement. Writing has always played a part in her life. She is the author of the books "Kaleidoskope, A Holistic Approach to Stress Management" and "Metamorphosis with a gentle touch".

During the 2020 lockdown she felt the urge to write down each day's feelings in the form of a poem. That's how the poems in the book Covid19-Odyssey came to life. One of her poems appears in this book.

## *A new day*

A new day has come your way

You can make the most of it

Start from a smile

Take this happiness to a mile

Work to create a difference

Work to make a change

Work with love and kindness

Work with gratitude and politeness

Work for a better you

Work for people large and few

Let this work seem like joy

Happiness when shared gives you joy

Bestow as it benefits both the receiver and the giver

Beauty of good deeds is the two way action

Make this soulful happy connection

A wave of change is there in the air

Embrace it and share happiness everywhere.

*Dr Ankita Marjadi*

*Birthing and Parenting at Times of Crisis*

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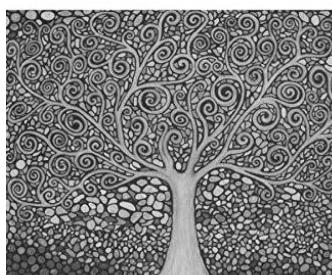
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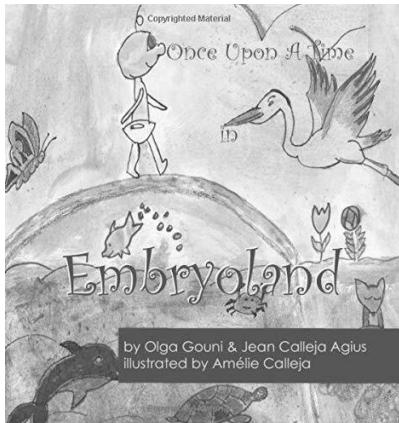
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The journey in Embryoland is truly an amazing odyssey - the most mystical imaginable. And, this beautifully illustrated narrative offers readers an incredibly imaginative journey to their own beginnings. Embryoland is, in fact, where we all have our beginnings It is a story of evolution at its creative core. It is indeed a work from the heart, which became a reality thanks to a solid basis of sincere friendship, close collaboration, determination, perseverance, patience and hard work. So, enjoy this book, and whatever your age, look at life through the innocent eyes of a child, and you will be mesmerised by its beauty and greatness, from the very start. Also available in Maltese ( Amazon) and Greek.

*Drawings made by the 6 year-old Amelie.*



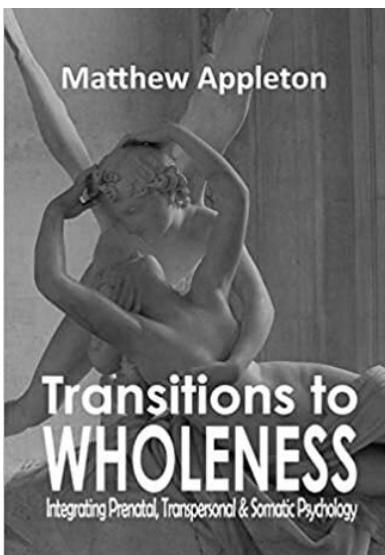
**Birth Stories**  
by Deirdre Munro, Ans Luyben  
& Jenny Clare  
Paperback – December 5, 2017,  
978-1981417537

The Special Birth Stories are 28 birth stories that represent special moments in the lives of the women, men and families that sent them, and still have a special place in their hearts, when they think about them. The stories are about the wonder of birth, but also about loss, risk and pain, have had a special impact on the writers, and their lives, and very special life-long feelings attached to them. This special book brings

to life the voices of women, men and their families through their stories at a particular time of the year which celebrates birth.

**Transitions to Wholeness:  
Integrating Prenatal,  
Transpersonal and Somatic  
Psychology**  
by Matthew Appleton  
*23 September 2020*  
*ISBN 979-8681823469*

Transitions offers a uniquely comprehensive grounding of pre and perinatal psychology, in the wider context of somatic and transpersonal psychology. The living expressiveness of the body, as championed by Wilhelm Reich, and the inner world of archetype and image, as revealed by CG Jung, are themes that run like vital arteries throughout the body of this book. Theory and principles of practice are animated by stories from personal life and the therapy room. This is a book which challenges us to ask questions about our own nature and our place in Nature. The book, also offers three comprehensive appendices. Appendix 1 shows "The Stages of Birth from the Baby's Perspective". Appendix 2 presents "Baby Body Language", in photos, showing the expressive nuances and emotional tones which hint at the lived experience of the individual in relation to particular prenatal and birth territory. Appendix 3 offers an overview of Psychological and Existential Themes associated with stages of prenatal life and birth, and which reside in the deep unconscious, until such time they are brought into conscious awareness.



## More titles in Greek

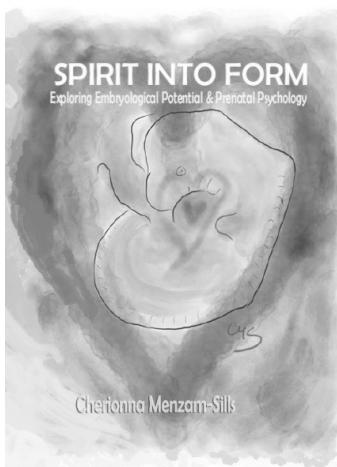


*SOUL DAYS, ΜΕΡΕΣ ΨΥΧΗΣ* (English/Greek), by  
Olga Gouni, Athens 2008, ISBN 978-960-98233-1-9,



*Καλωσόρισες!* (Greek), by Olga Gouni,  
Athens 2009, ISBN 978-960-98233-2-6

# To come out soon!

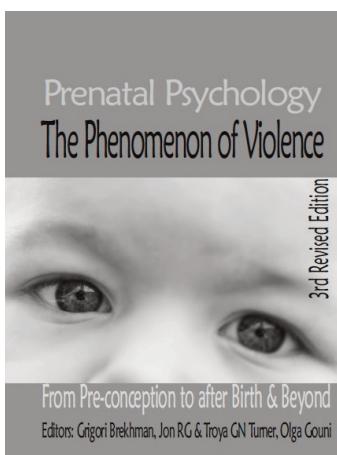


## SPIRIT INTO FORM

Exploring Embryological Potential &  
Prenatal Psychology  
by Cherionna Menzam-Sills  
*ISBN 9798700119771*

Cherionna Menzam-Sills's book, *Spirit into Form*, is based on her long experience as a craniosacral therapist and somatic prenatal and birth therapist. Cherionna takes you on a tour of important developmental stages during gestation. But in addition to that, she has much to say about the larger fields of Love, Spirit, and Soul and how they are connected to the body. The scope of the material is wide, broad and encompassing.

Cherionna's message is that when we come to understand our early experiences and how they establish in us lifelong patterns, habits, addictions and tendencies, we can begin to integrate, let go, and make new choices. Her book is a subtle distillation of wisdom, stylistic grace, and excellent advice for pregnant or soon-to-be pregnant persons. Highly recommended. **Thomas R. Verny MD, DHL (Hon), DPsych, FRCPC, FAPA**



## Prenatal Psychology:

### The Phenomenon of Violence

(3rd revised edition)

Editors: Grigori Brekhman, Jon RG & Troya GN Turner, Olga Gouni

This book examines one of the most urgent problems of modern times: aggression and violence. During the 20th century, humankind has gone through two World wars and innumerable interstate wars and conflicts, revolutions and cataclysms. Despite protests, people have failed to find ways to stop disastrous displays of state violence, street violence, religious violence,

domestic violence, interpersonal violence. Humanity entered the 21st century with hope for peace. The book draws public attention to the origins of this phenomenon.

**THE CURE FOR COLIC**  
The Relief & Joy of Bonding with  
your Baby  
by Karlton Terry

The experience of birth is an epic transition each of us has traversed. It shapes everyone in ways that go mostly unrecognized by themselves and others. Psychological consequences from prenatal life and birth are powerful, persistent, and pervasive. The book is a gift to parents who wish to support their babies' natural healing processes once they learn how to do it. And although it is not a parenting book per se, one of its principle goals is to help parents understand how to support their babies to heal from the deep challenges of embodiment and birth.



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PRENATAL & LIFE SCIENCES

COSMOANELIXIS, Prenatal & life Sciences is an educational organization that has been created in order to organize, synthesize and deliver high quality academic and professional knowledge to those interested. It has been created as an answer to the global need for optimum education in a field that has been explored for over 100 years now in the modern times. It offers a full program of specialization educational program of 5 years (online) but professionals can also study individual modules as well. Cosmoanelixis is also involved in academic research in the field, publishes books in Prenatal Psychology and develops IJPLS. The International Journal of Prenatal & Life Sciences (IJPLS) is an Academic, open-access, double-blind, peer-reviewed, International, Online Journal publishing authentic papers to disseminate new knowledge and research findings in the field of Prenatal and Life Sciences. Apart from research studies, it welcomes reviews, critiques of studies and findings, case reports, summaries and opinions after due peer review, as well as book/film reviews.<https://www.cosmoanelixis.gr>

**Cite:**

Gouni O, Turner RG J, Turner T, 2021, *Change: Birthing and Parenting at Times of Crisis*, cosmoanelixis, Athens, ISBN-13: 979-8705980154

We stand in the midst of a critical change. The whole world, as we have known it, is in transition. Day by day, we witness the death of the old way of being, while the new is a little hazy to see and embrace. The pandemic, a mirror of the “unseen virus” that finally crystallized into the physical virus, affects humans debilitating systems -not only organic but also socio-economic ones placing a strain on the equilibrium of all the intricately related factors inside and outside all known structures. With the educational and other care systems falling apart, or not allowed to function properly, families and especially parents have seen their everyday life go chaotic. The new reality asks them to re-visit their parenting modes, understand the essence of it all and lead themselves and their children, still in gestation or already born and growing up, to a new homeostasis. As in all transition phases, the primal trauma is re-activated. The primal pain from which we disconnected to survive is to surface again. Exhaustion, anger, isolation, social-distancing, FEAR, mainly fear of death, has become the daily menu in an atmosphere of mistrust, insecurity and loss. But this is also the time to heal, regain the lost life energy and re-create what has always been possible. This book, written by 20 experts in the fields of Prenatal Psychology, Medicine and Health is the navigator that leads each one of us, born or unborn, to the space of using critical changes as a tool to heal our prenatal trauma, reconnect with who we are, connect with and support our children as we make our next step.

## Athens, 2021

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