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Molecules of Life

Introduction to prediventive, regenerative
and personalized health medicine

Vol. I





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We may claim without conceit that this text is the only attempt in the world to join together, in a complex and comprehensive overview, anti-aging medicine, molecular medicine and genomic medicine, with the aim of integrating them into academic medicine and giving birth to a health medicine, which is practical, simple, effective and decisive. We are fully aware that a text on popular medicine, which originally addressed "common people" in the attempt to persuade them to preserve a good state of health (the first requirement for a long and healthy life), turned little by little into an "introductory" text to regenerative and personalized preventive medicine, so that it seems to be mainly addressed to doctors, health workers, wellbeing and fitness workers, lawgivers, Schools of Medicine, Pharmacy, Biology, Information Technology and Exercise Science. In order to guarantee the original target, we enriched the text with pictures and easily readable and understandable comments addressed to the primary recipient. But without losing sight of the scientific evidence of the subject. This is the only way to make the reader understand and share the historic revolution of medicine we will experience during the 21st century and that will turn fiction into reality. In doing so, however, we unintentionally forced our publisher Aracne to divide

the text into two volumes. For this reason, we sincerely thank the patience and professionalism of all those people within Aracne's team, who supervised and corrected the text. As a consequence, we hope the majority of our readers will be represented by laymen.

Preface

Everyone desires long life, not one old age.

Jonathan Swift

Over the last 20 years, medical research in the United States has increasingly been focusing on the centrality of the patients, on their lives and, as a consequence, on their health. This trend is gaining more and more ground in Europe as well.

It could be described as the revolution of the “medicine of life” as opposed to the “medicine of death”, which still represents present-day medicine. Traditional medicine, which was conceived to fight illnesses and treat the pathology, is currently turning into a new medical science aimed at preventing damages and focused on the patient’s wellbeing, as well as on the best possible quality of life.

Fifty-four years have passed since the discovery of the double-helix structure of DNA by Francis Crick and James Watson in 1953. A feverish rush towards the disclosure and understanding of life has started ever since.

Since then, starting from the birth of *molecular* biology (which can be regarded as the science of life), biology has paradoxically experienced a separation between biological research and conventional medicine.

As a matter of fact, the stream of knowledge derived from the interconnection between biology, information sciences and nanotechnology has been acknowledged by the academic medical world as a generic field of research, without being applied to clinical practice.

The remarkable advances and extraordinary achievements of conventional medicine undoubtedly enable us to live longer. Nevertheless, our extreme vulnerability to chronic degenerative diseases has made the burden of social welfare unbearable by now.

In the last ten years new extraordinary tools were developed to mark the historic turning point in the field of conventional medicine

that the scientific world is still awaiting and postmodern society demands urgently: the shift from a medicine of illness and death to a health medicine and life.

In the preface to *Il Manifesto della lunga vita* (by Paolo Marandola and Francesco Marotta, Sperling & Kupfer, 2007), the oncology luminary Umberto Veronesi, states:

The aim of science is not to extend life expectancy, but to extend the time without suffering and pain, and therefore to assure the best quality of life to the largest number of people. More precisely, the purpose of medicine is to increasingly improve life's report card, to fight against time in order to gain freedom from illness as long as possible. Doctors must take care of their patients especially when they are in perfect health.

However, many people wonder whether prolonging our average life expectancy is legitimate from an ethical and social point of view. Veronesi answers:

Even though life expectancy has remarkably increased over the last few years thanks to the advances of medicine, scientific research has never aimed at escaping death, but rather at understanding how it occurs, and why, in order to use such information for the benefit of mankind. However, even though we "scientifically" accept the end of our life, there is no reason to "ethically" oppose to its extension, in a condition of mental alertness and physical autonomy.

In accordance with Veronesi's statements and the so-called "personalized health medicine", doctors and medical science become tools at the service of the person.

We are currently witnessing the extraordinary evolution of *preventive* medicine into *predictive* medicine. Jean Dausset, who was awarded the Nobel prize in 1980 for his genetic researches into the human immune system, is the pioneer of this movement. According to his new "vision", the diagnostic process is reversed: the diagnosis is made before the patients show any evidence of disease, before they fall ill, even before they are born. It is also possible to create a genetic card of the expected risks of the newborn baby, in a world where healthy men and women will have to face life bravely and will know their future so well that they will be able to choose the lifestyle that best suits their genetic "structure". Even though, in those years, biology didn't

have the tools and the knowledge that would give birth to molecular biology (which we will get to know as *genomics* later on in this volume) a few decades later, Dausset's contribution was extremely important.

Today, new medical knowledge can rely on the sophisticated technologies of information technology (genome mapping) and nanomedicine.

Biotechnology enabled different groups of specialists to develop new systems based on the identification, on a genetic basis, of the risks for every single person of developing a disease at any time in their lives.

It is thanks to the advances in genomic diagnostics that medicine can extend its efforts towards predictive medicine. It is possible to intervene in a way aimed at lowering the chances of falling ill with a pathology we are genetically predisposed to.

This text, which is the sequel to *Il Manifesto della lunga vita*, discloses those secrets that have been the prerogative of a few scientists so far and reveals the codes of the scientific language, thus helping the reader understand what a disease (which is often caused by an alteration of one or more genes in our DNA) really is. It is therefore a real Copernican revolution in the world of health and in the hope of living a long and healthy life: the practical manifesto of a new anti-ageing medicine.

Since a scientific mindset helps us not to be afraid of death, it also helps us not to be afraid of life even more so: the healthiest and longest possible life.

Starting from these assumptions, this book pays homage to the knowledge of the new tools that enable us to restore the centrality of our lives, and therefore of our health.

Why we are here

Before going into the world of the genetics of life, into the mechanisms of the ageing process and into the secrets that help us to block it, it would be helpful to wonder why we are here on Earth and why we are bound to die bit by bit. It is necessary to understand life in order to understand death.

This work is conceived as a popular text on molecular medicine and doesn't aim at going into metaphysics, theology, natural science

or cosmology. However, the author cannot help but think of the objections expressed by the human being who, since ancient times, has always made an attempt to oppose to the “established” rules that fixed the duration and quality of life. For this reason, it is necessary to briefly mention the big existential issues faced by philosophy (Aristotle, Plato), religion and theology (Augustine, Thomas Aquinas) and, more recently, by science (Galileo, Newton, Einstein).

Paul Davies, a renowned English astrophysicist, writes:

Many wonderful phenomena have emerged in the universe: monstrous black holes weighing as much as a billion suns that eat stars and spew forth jets of gas; neutron stars spinning a thousand times a second, their material crushed to a billion tons per cubic centimetre; subatomic particles so elusive that they could penetrate light-years of solid lead. Yet, amazing though these things may be, the phenomenon of life is more remarkable than all of them put together (Paul Davies, *The search for the origin and meaning of life*, 1998).

Another famous English astrophysicist, Stephen Hawking, writes:

We each exist for but a short time, and in that time explore but a small part of the whole universe. But humans are a curious species. We wonder, we seek answers. Living this vast world that is by turns kind and cruel, and gazing at the immense heavens above, people have always asked a multitude of questions (*The Grand Design*, 2010).

In ancient times, since they did not know anything at all about nature’s behaviours, people invented gods in order to explain every aspect of human life: gods of love and war, of Sun, of Earth, of Heaven, of oceans, of rivers, of rain, of storms and even of ailments and diseases. Whenever these gods were unsatisfied or enraged, they used to give vent to their fury by sending wars, drought, plague and epidemic. As our ancestors didn’t have the necessary tools to indentify the cause-and-effect relationship between the different natural phenomena, they entrusted the gods with their fate and developed those beliefs that would give birth to religion and philosophy.

It was not until 2600 b.C. that a Greek philosopher, Thales of Miletus (c. 624–c. 546 b.C.), paved the way for new theories, according to which nature complied with consistent and decipherable principles. However, it took over 2500 years before the shift from the idea of

a universe controlled by gods to the concept of a system ruled by natural laws (and created in accordance with a project that we could possibly decode, sooner or later) gained ground.

During the Greek–Roman age, several *discoveries* took place that, however, did not give birth to any natural science. Let's think of Democritus (c. 460–c. 370 b.C.), a Greek scientist who, by observing the breaking up of some objects, invented the first modern scientific word: *atom*, which means indeed “that cannot be cut”.

Anaximander, Empedocles, Pythagoras, Aristarchus, Epicur, Aristotle and Plato are the great scientists and philosophers of the classical age, who laid the foundations for the development of natural sciences. Twenty centuries later, Galileo, Descartes, Laplace and Newton followed this path.

Seemingly, everyone agrees on the uniqueness of the laws determining both the universe and human behaviours.

Even though we believe we can choose what to do, what we learn from molecular biology is that every biological process is controlled by physical and chemical laws, just like the orbits of the planets.

Hawking states:

As for a presumed creator of the grand design, science proves that the universe can create itself from nothing on the base of physical and mathematical laws. It is not necessary to invoke God to light the blue touch paper and set the universe going. Spontaneous creation is the reason there is something rather than nothing, why the universe exists, why we exist.

In his book *The mind of God*, Davies writes:

Through science, we human beings are able to grasp at least some of nature's secrets. We have cracked part of the cosmic code. The reason why this has happened remains a mystery. We, who are the children of the universe, can reflect on the nature of the same universe, even to the extent of glimpsing the rules on which it runs. How we have become linked into this cosmic dimension is a mystery. Yet the linkage cannot be denied. What does it all mean? What is man that we might be party of such a privilege? I cannot believe that our existence in this universe is a mere quirk of fate, an accident of history, an incidental blip in the great cosmic drama. Our involvement is too intimate: the species *Homo* may even mean nothing, but the existence of mind in some organism on some planet in the universe is surely a fact of fundamental significance. Through conscious beings the

universe has generated self-awareness: this can be no trivial detail, no minor by-product of mindless, purposeless forces. We are truly meant to be here.

This volume doesn't aim at discussing the tricky topic of Creation. Nevertheless, it is necessary to quote some philosophical and scientific developments dealing with the endless issue of creation, which will enable the reader to go into the different interpretations. Even though there are several schools of thought and different interpretations, the assumption on the human being's nature cannot be questioned: the human being is not *spirit*, but consists of molecules that constitute the human essence and that men themselves can change. In more prosaic (medical) words, we can speak about a life that can be decoded and changed. *Ageing* and *anti-ageing*. The most interested readers will find a short bibliography about the origin of the world and of human life at the end of this chapter.

The analogy proposed by the English astronomer Fred Hoyle (from the interview *Hoyle on evolution*, "Nature", vol. 294, 12th November 1981, p. 105) seems to agree with the creationists:

The chance that a spontaneous process can put a living being together is comparable to the chance that a tornado sweeping through a junkyard might assemble a Boeing 747 from the materials therein.

In order to better understand the philosophical and theological intricacies according to which life is intentionally created by someone or something, I am going to quote some excerpts by an extremely clear-headed Italian theologian (even though his theoretical conclusions are deeply influenced by a preconstituted religious point of view): Vito Mancuso, with his beautiful texts *L'anima e il suo destino* (Cortina, 2007) and *Io e Dio. Una guida dei peplessi* (Garzanti Libri, 2011).

In *Io e Dio*, Mancuso writes: «This life is a hospital where every patient is possessed with the desire to change beds... It always seems to me that I should feel well in the place where I am not, and this question of removal is one which I discuss incessantly with my soul».

The author proposes several destinations: Rotterdam, Batavia, Tornea, but his soul remains silent: «At last my soul explodes, and wisely cries out to me: "No matter where! No matter where! As long as it's out of the world!"».

Life as a hospital, life as an endless fight against the world, and therefore against life itself.

Transcendence — God, divinity, the Divine — sets itself against the protest towards the inhospitable hospital of life, as a dream or a longing for a place where our soul would stop protesting because it feels at home at last.

However, if we take into consideration what life is from a physical point of view, this vision is incomplete. Paul Davies believes that the theory of “fortuitous event” is an explanation of the origin of life. The “chemical fluke theory”:

Life requires hundreds of thousands of proteins and the chances of them all coming together at random are one in $10 / 40,000$. This means 1 followed by 40,000 zeros, a number that, written in full, would take up a whole chapter of this book. The odds on dealing a perfect hand of cards a thousand times in succession is as nothing by comparison.

According to Vito Mancuso, religion is born from the life surplus in comparison with our ability to control it. The gap between the “whole” in which man is included and what man can control of the whole itself is the space of religion.

The divine element can be experienced both as *mysterium tremendum* and as *mysterium fascinans*. From the *fascinans* point of view, the sacred is a feeling of bliss and salvation thanks to the benevolence of a deity, whose indulgence, mercy, closeness, pity, compassion and love are perceived. In this perspective, *henosis* can be reached, namely the oneness with God, which can be expressed either as an absorption of our personality in God or as a deification. That is to say, men keep their personality but change their nature. They become divine, or whatever it means. Should we be considered hyper-scientific beings only because we explain miraculous recoveries through science? Science can explain religion, not the other way round.

Religion, with its manifold and conflicting manifestations, is nothing but the attempt to get through the mystery of life in its entirety, the attempt to grasp its wild beauty (cathedral) and not to be crushed by its upsetting imponderability (hospital).

Religion is at the service of life, life is not at the service of religion.

Hyginus (Hyginus, *Fabulae*, quoted by M. Heidegger, *Being and Time*, 1927) answers both the big questions about the existence of God

and the philosophical question “why life?”:

As Care crossed a stream one day, she saw some clay: picking up a piece in contemplation, she began to shape it. While she reflected upon what she had created, Jupiter approached her. Care asked him to provide spirit to the clay form. This he was pleased to do for her. But when she wished to apply to the creation her name, Jupiter forbade it, saying that his name ought to be applied. While Care and Jupiter argued over the name, the Earth approached and asked that the creation to be named after her since she had, after all, given it a part of her body. The three contenders then asked Saturn to settle the matter. And Saturn gave them decision, seemingly just, as follows: «You, Jupiter, because you have provided the spirit, should receive the spirit when the creature dies; you, Earth, because you provided the body, should receive the body. But because Care first shaped this creature, so must it be that she possesses it for the time of its life. And because the name is subject to dispute, so should it be that it is called *Homo*, since it is made out of *humus* (Earth)».

In *L'anima e il suo destino*, Mancuso states:

Being is one and only for every thinkable phenomenon, it is the same for the stars, the sea, the trees, the gazelles, men, and this one and only being is called energy. At this stage, there is no difference between man and the world: the stars, the sea, the trees, the gazelles are energy, as well as man, just like any other piece of the world. The difference arises when the actual shaping with which energy reveals itself as matter. Although energy, which is the primordial being, is the same in every phenomenon, the stars are different from the trees, and men are different from the gazelles. But why, if energy is one and only? In order to express this variety in the different being's stages, many centuries before Christ, men distinguished inside themselves their body's sphere from their soul's one. And within soul's sphere they identified further hierarchically arranged dispositions. Let's analyse the first one.

Let's consider a stone. Just like any natural body, it is made up by molecules, and molecules by atoms. One of these atoms, like every atom among the over hundred known natural elements, consists of a nucleus (protons and neutron, particles that, in turn, are made up by even smaller particles) and of some electrons that, so to say, go round it. Compared with the atom's volume, the nucleus is extremely small. Compared with the nucleus, electrons are even smaller, they are so evanescent in their substantiality that we don't know whether they are corpuscles or waves. This means that the atom is basically empty: «If we wanted to represent an atom with its right proportions and drew 10-centimetre-sized protons and

neutrons, the whole atom should measure 10 kilometres. What keeps this huge empty space together, making it so impenetrable to constitute what has been regarded for a long time as the fundamental indivisible element of matter, is the energy developed by the flow of the cloud of electrons around the nucleus at a speed, they say, of 100 kilometres per hour.

Supposing that this is the foundation of being, it is clear that energy exists before matter, or rather matter in its customary meaning of “dead matter” doesn’t exist, that matter itself is nothing but energy that springs from the movement of primordial elements, which in turn are perhaps not tiny dots but, more properly, waves. Nothing is still, static, no substance: the secret of being is movement. Even what seems to be motionless, motionless like a stone, is actually energy in constant movement, at a speed we cannot even figure out.

Let’s consider a human body. What we said about stone doesn’t change: the atom’s structure is identical, it is the flow of the electrons around the nucleus that keeps the billions of billions of atoms together. Just like the stone, the human body is basically empty as well. The impenetrability of bodies, an axiom of ancient science, is by now ridiculed by the uninterrupted flow of a daily indefinite number of electromagnetic waves. According to fundamental physics, we are empty. Our body is nothing but condensed energy, even better energy that continuously condenses because of the whirl of billion of connections between the fundamental elements. But, unlike the stone, our body moves. It is alive. The movement of the atomic elements that constitute the stone produces immobility, whereas the movement of the atomic elements that constitute our body (or any other living body) produces in turn further movement, produces what we call life. Why? Why, if everything moves in the same way, something develops into a still lifeless body, whereas something else into a mobile and living body?

The answer is in a different shaping of the energy. In the first case, the whole energy is condensed in the body mass. In the second one, the energy springing from the atomic movement is not entirely contained in the body mass, but provides a surplus, an excess. Such exceeding (if compared to the mass) energy makes the body alive, animated. In this first stage of being, the soul is explained as the surplus of energy compared with the material shaping of the body. If life managed to spring here on our planet, and who knows where else in other cosmic forges in the universe, it is thanks to the gap between the heat produced by the atomic movement and the material shaping that springs from this movement. This gap, this exceeding energy, is the secret of life: is the soul. The greatest among ancient Greeks had guessed it and named it *pneuma* (even though we translate it as “spirit” this word means “wind”, just like *anemos*), the movement, the heat, the spur of energy. Simone Weil writes: «The Greek word translated as spirit means actually igneous breath, breath combined to fire, and in ancient times it referred to the element that modern science refers to as energy».

Without this fundamental understanding of the being as energy, life cannot be explained: life exists exactly because it can't be reduced, as the stone can instead, to inanimate matter. What's more, not even a stone is reducible to this poor concept, since even stones evolve, even diamonds and rubies have built themselves up in the course of time, not to mention pearls and corals, which have an organic origin. Everything lives, in their own way. Those who attempt to explain life by reducing it to the deterministic laws of a nonexistent inanimate matter betrays the very essence of life, that is the energy, the movement, the vital breath. Materialism is the poorest of philosophies.

The Russian–Belgian chemist and Nobel prize winner Ilya Prigogine, in his famous text *Order out of chaos* (1984) states that life is not born from randomness but from the intrinsic properties of matter.

All physicists, both believers and atheists, share the concept of cosmic blueprint.

In his book *Vital dust* (1996), Christian de Duve, the founder of the *International Institute of Cellular and Molecular Pathology*, questions Jacques Monod's statement, according to which «the universe was not pregnant with life, nor the biosphere with man». According to de Duve, life and mind are not the result of more or less whimsical chance, but natural displays of matter, written in the fabric of the universe. De Duve regards this universe not as a “cosmic joke”, but as an entity with its own meaning, which can give birth to life. Life will in turn originate thinking beings, who are able to distinguish the truth, to understand beauty, to feel love, to desire good, to define evil, to experience mystery.

The supporters of the *intelligent design* tried to identify in de Duve's vision an explicit reference to God's intervention, to the point that de Duve himself was forced to explain: «I do not mention God at all. . . the key word is *chemistry*, not some preconceived idea about how things should go».

Concerning this, Mancuso writes:

If the key word is chemistry, and if chemistry gives birth to some meaning, then finally the classic concept of finality, free from any dogmatic claim and from any equally dogmatic opposite claim, is gaining ground again in contemporary science. A finality that is intrinsic to nature, conceived as *entelechia* from an Aristotelian point of view, which therefore has its own *telos*.

The conclusion I drew from de Duve's hypotheses is that evil was not born from universal physical laws but, juke like illness, is a molecular deviance or alteration in the course of evolution. Sooner or later, this alteration will be corrected and cancelled, as well as illness will be corrected or cancelled.

It was therefore religion that, with no other options, dealt with the issue of evil.

Even the original sin is a digestible stage of human evolution. Men were born virgin, that is healthy, and then they were subjected to sin or, from a chemical point of view, to molecular alterations. Is science recovering what it lost sight of in the past few millennia?

As soon as physicists, mathematicians, biologists and cosmologists disclose thoroughly the secrets of life and the universe, the role of philosophy, theology and biology will change dramatically.

For the time being, or perhaps for the next few millennia, we still "need God". Whenever we fall ill or are at death's door, we will still invoke God's name together with our mother's, even though we know that neither of them can help us. Why should God favour Paolo rather than John, or Ahmed, or Jin?

The scientific interpretation sets itself against religion: the human body is nothing but physical and chemical energy, which molecular and genetic science has begun to decode and control. This concept belies the statements of a great post-creationist physicist, Antonino Zichichi, whom I was pleased to meet in his beautiful scientific environment in Erice. He believes that the biology of human knowledge lags behind in comparison with particle physics. In this regard, we can mention his heated "ideological dispute" with the famous oncologist Umberto Veronesi on the subject of the existence of God.

On the occasion of the presentation of his book, *Il mestiere di uomo* (2014), Veronesi summarized his ultimate moral sense and the rediscovered ethical strength he dealt with in this autobiographical book. He turned from a believer into an agnostic and stated that God does not exist. The ontological evidence of such a statement lies in the never-ending *theodicy* (divine justice) that has always troubled the philosophers in connection with the theological issue. Why does God allow evil? Veronesi's theory is simple and sharp: «After Auschwitz, cancer is further proof that God does not exist». According to Veronesi, both as a man and as an oncologist, it is unthinkable to imagine God

while being aware of the evil in the world: an uncalled-for evil, which can involve innocent children, suffering from lethal and incurable diseases. This is not consistent with the idea of the almighty and merciful being depicted by monotheist religions. According to Veronesi, men should abandon this metaphysical vision of life and take their moral and ethical responsibilities.

Zichichi's answer is instead a cosmological one. As a physicist, he starts from the creation of everything. He states: «The universe is instead a proof of the existence of God. Science and faith should be the two load-bearing columns of the third millennium». According to the scientist, the existence itself of a universe (i.e. something determined by exact physical laws) proves that a creator, namely an intelligent mind, designed it. However, we wonder: does the universe really prove that physical laws exist, or rather our physical laws are a language we use to decode something otherwise incomprehensible? Perhaps professor Zichichi doesn't take into consideration that modern science, especially as far as quantum theory is concerned, is currently paying more attention to the idea of chaos, introducing such topics as the multiverse (different laws for different physical systems, created by chance after endless attempts).

The Italian geneticist Edoardo Boncinelli is another scholar who devoted himself to the eternal fight between religion and science in their attempt to disclose the mystery of life. In his book *La scienza non ha bisogno di Dio*, he claims that science doesn't need God because it is a purely human achievement, based on the noblest and most debated of its faculties: rational thought. The idea that this could imply a divine spark is at least debatable. This spark can be identified either in a volcanic eruption or in any other natural phenomenon. The pregnancy of *sense* that most religions have always instilled into man seems a pathetic attempt to deny our belonging to this very nature, from which we want to rise because of our presumed and acquired divine offspring. In other words, the geneticist believes that science doesn't need to bother God for an apodictic verification: we managed to understand the laws that govern the universe, and that found through the centuries an exact systematization thanks to physical, chemical and mathematical laws, without taking in consideration (and sometimes in spite of) the intrusive presence of God, with his presumed unchangeable (misleading) laws.