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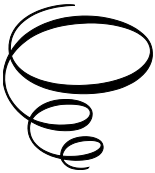

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This book is dedicated to the memory of my daughter
T.M. Ponizovska.

CONTENTS

PREFACE

This book publishes a study of the human organism in its normal stationary state, as well as in a quasi-stationary pathological state, from the point of view of biochemistry, biophysics, and thermodynamics. Also, it describes some therapeutic methods. This book discusses the experimental results from the point of view of biochemistry, thermodynamics, and biophysics, dealing with broad views on the mechanisms of mutual interaction between an organism and its environment. The importance of this book is that the development of an organism, from the moment of birth, throughout its life, and on to its death, as well as its cells and cellular genomics is explained from the viewpoints of thermodynamics, biophysics, and biochemistry, while also considering mechanisms of mutual interaction between an organism and its environment (the atmosphere of the Solar System). This is the special feature of this book when compared to other similar books. The purpose of this book "Biophysical and Biochemical Mechanisms of the Normal and Pathological Development of an Organism in Life, Disease, and Death", subtitled "The Normal and Pathological Development of the Human Organism in the Atmosphere of the Solar System", is to explain the development of an organism, including its cells, from birth through life in health and disease from the point of view of thermodynamics, also considering mutual exchanges with energy and substances between an open thermodynamic system of an organism and the open thermodynamic system of the atmosphere in the condition of the solar thermodynamic system. On the one hand, we are examining the relationship between the open thermodynamic systems of an organism and its cells. On the other hand, we are investigating the relationship between the open thermodynamic system of an organism and the thermodynamic system of the atmosphere of the solar thermodynamic system. The mutual exchanges of energy and substances between an organism and this atmosphere create the biophysical and biochemical mechanisms to maintain the stability of the internal energy of an organism and its cells, as well as of the atmosphere, as proved in this book by the use of Prigogine's theorem.

Also, there are processes described occurring in the Sun, through the estimation of the influence of solar processes on mechanisms forming inorganic elements in the Solar System (stratosphere, ionosphere, and atmosphere etc.), and the influence of solar processes on Earth in relation to non-living substances and living organisms and to both eukaryotic and prokaryotic organisms, especially human organisms. These influences can be both useful and harmful.

By studying the open non-equilibrium non-linear thermodynamic system of an organism, we explain the mechanisms by which the human organism maintains the stability of its internal energy and internal medium, as well as the stability of the internal energy and internal medium of its cells, both in norm and pathology from the point of view of thermodynamic laws. In addition, we can estimate the positive and negative impacts of solar radition, especially solar thermonuclear synthesis, on inorganic elements, organic substances, and living organisms, which cause positive and negative interactions between prokaryotic and eukaryotic organisms. For example, a balance between fusion and fission in solar thermonuclear synthesis, results in the biosynthesis of simple inorganic elements, organic substances, and possibly also simple unicellular prokaryotic organisms. Certain quanta of solar thermonuclear synthesis are useful for processes in eukaryotic organisms, e.g. producing vitamin D and others. However, some quanta of solar thermonuclear synthesis can be harmful for eukaryotic organisms, e.g. generating pathologic viruses and some other pathogenic prokaryotic organisms. Some prokaryotic organisms, such as pathological viruses, cannot live independently of eukaryotic organisms and cause them harm.

Unicellular prokaryotic organisms have very short lifespans and some unicellular prokaryotic organisms need a eukaryotic organism to host them. However, symbiosis between eukaryotic organisms and some unicellular prokaryotic organisms can be useful, as with the production of vitamins (vitamin B_{12} etc.), microelements, and other useful substances. In addition, eukaryotic organisms need nutrition from some organisms for their metabolism, delivering energy and substances for the maintenance of the stability of internal energy (a temperature of 36.6 °C etc.) in an organism according to the first law of thermodynamics.

This book explains the thermodynamic mechanisms that result in the stability of the open non-equilibrium non-linear thermodynamic system of the human organism, according to Prigogine's theorem and Glansdorff and Prigogine's theory. Furthermore, the book explains the mechanisms of mutual interaction and interdependence between the thermodynamic system of an organism and the thermodynamic system of the cells of an organism for the maintenance of stable internal energy of both an organism and cells of an organism. Mechanisms in the operation of cellular capacitors generate resonance waves, the activities of which contribute to the maintenance of the stability of the cells' internal energy. Moreover, the book describes the mechanisms of remote cellular reactions caused by resonance waves via the operation of cellular capacitors, which exert reactions of immune cells leading to immune responses in an organism to strange substances, and ensure the stability of the internal energy and internal medium of an organism. Also there were described the mechanisms of human mental reaction of an organism in condition of interactions with environment.

The interdependence between nuclear capacitors, mitochondrial capacitors, intracellular organelle capacitors, and cellular capacitors for the maintenance of stability in the internal energy of both an organism and its cells are also described. This book elucidates mechanisms of the oscillating interdependence between anabolic and catabolic processes, both in the nucleus and the mitochondria, which leads to cellular development according to Glansdorff and Prigogine's theory. The development of an organism from its birth up to its death has been elucidated in terms of the expenditure of stored genetic energy creating non linear fluctuations in entropy according to Glansdorff and Prigogine's theory. The stability of the internal energy and medium of an organism is presented by stable biochemical and biophysical indices, which are regulated by chemical mechanisms at three levels, as well as by the operation of cellular capacitors via resonance waves.

There were elucidated mechanisms pathologic states of an organism, including oncogenesis of cancer diseases and the estimating methods of their treatments.

INTRODUCTION

A human organism can be described as an open non-equilibrium non-linear thermodynamic system, which is subjected to thermodynamic laws. The open non-equilibrium non-linear thermodynamic system of an organism displays mechanisms for maintaining the stability of its internal energy, as well as mechanisms for maintaining the stability of the internal energy of its cells, both under normal and pathological conditions according to the first law of thermodynamics. Using Prigogine's theorem, we explain the mechanisms that maintain the stability of the internal energy of the open non-equilibrium thermodynamic system of the human organism. Glansdorff and Prigogine's theory describes the mechanism for the non-linear development of an open non-equilibrium thermodynamic system of the human organism. The main thermodynamic parameters of the open non-equilibrium non-linear thermodynamic system of the human organism are calculated. Additionally, the mechanisms of mutual interaction and interdependence between the thermodynamic system of an organism and the thermodynamic systems of its cells maintain the stability of internal energy, both at the level of the whole organism and at the cellular level, via the operation of cellular capacitors generating supplemental maintenance of internal energy of an organism. The interdependence of nuclear capacitors, mitochondrial capacitors, intracellular organelle capacitors, and cellular capacitors represents another mechanism for maintaining the stability of internal energy in both an organism and its cells. The oscillating expression of either anabolic or catabolic processes with the interdependence of the operations of the nucleus and mitochondria leads to cellular development via the cellular cycle, which corresponds to the mechanisms of interaction between the intracellular medium and extracellular medium, according to Theorell's equation.

Considering the first law of thermodynamics, the regulatory system of an organism maintains the stability of the internal energy of the open thermodynamic system of an organism via three levels of biochemical

regulation. The regulatory mechanisms of an organism are also subjected to the permanent influence of the environment. The organism's mechanisms of resistance to the permanent influence of the environment operate via biophysical and biochemical mechanisms of cellular reaction, which are supplementally important mechanisms. Cells from all parts of an organism (i.e. blood, lymph, cerebrospinal fluid, and tissue) are connected with one another due to remote reactions that operate across the operative distance of the cellular capacitors via resonance waves, maintaining common stability of the internal energy and internal medium in both the cells and the organism. This results in a defensive immune system, autophagy, autoimmnune reactions, and the exchange of energy and substances between the environment and the organism. The mechanisms of interaction between nuclear capacitors, mitochondrial capacitors, organelle capacitors, and cellular capacitors maintain the stability of the cytoplasmic chemical potential ($\mu_{cytopl.}$) ensuring stability of the internal energy of the cells.

In the violation of tissue cells, the mechanisms of interaction between nuclear capacitors, mitochondrial capacitors, organelle capacitors, and cellular capacitors destroy the internal energies of tissues leading to quasi-stationary pathological states. Also, interdependence between mechanisms that maintain the stability of the internal energy of a human organism and the mechanisms that maintain the stability of the internal energy of the environment (the atmosphere) are interdependent and are engaged by the inflow and outflow of energy and substances, driving the mechanism for the development of life on Earth. These mutual exchanges of energy, between the open non-equilibrium non-linear thermodynamic system of the human organism and the thermodynamic system of the environment, are influenced by the activity of the Sun. The Sun and even the Solar System generate mechanisms that maintain energy stability at each level of the solar thermodynamic system. The mechanisms that maintain the stability of a stationary state in the open non-equilibrium non-linear thermodynamic system of an able-bodied organism and a quasi-stationary state in the open non-equilibrium non-linear thermodynamic system of a sick organism have been explained by studies into the violation of cellular processes in the G_0, G1, S, and M phases of the cellular cycle and from the perspectives of biochemistry, biophysics, and thermodynamics. In the

study of the various pathological states of an organism, most attention has been given to oncological diseases because of their spread around world. The Warburg effect of cancer metabolism determines the mechanisms that drive irrepressible cellular proliferation resulting in rampant and excessive tumor growth, as well as the mechanisms of cancer metastasis, the invasiveness of cancer, and its resistance to apoptosis etc.

The differences in the mechanism of the Warburg effect in cancer tissue and the mechanism of the Pasteur effect in healthy tissue are explained.

The genetic mechanisms have been elucidated relating to the open thermodynamic system of the organism via the calculation of its primary thermodynamic indices. Genomic mechanisms of the normal cellular cycle include genomic mechanisms of energy expenditure, inherited from both parents, relating to the activity of stem cells and the lifecycle of each cell. We also elucidate advanced genomic mechanisms of the human eukaryotic organism in its transformation from a single pluripotent cell into a multicellular embryo and then a living organism, in which the genomic mechanism of embryogenesis plays a role in the normal functioning of the open thermodynamic system of an organism. In relation to this, we describe the mechanisms of gametogenesis, the impregnation of the ovum by sperm, and the growth of a foetus from a single cell, while considering flows of energy from stem cells to type cells. The genesis and development of an organism has been explained by Glansdorff and Prigogine's theory, concerning the various stages of human development: birth; childhood; juvenile age; middle age; and old age. Moreover, the following mechanisms that transition into pathology have been elucidated: disordered genomic mechanisms of an organism's open thermodynamic system resulting in cancer pathologies; the transmutation of the mitochondrial function of cancer oncogenesis; the transmutation of chronic inflammation resulting in cancer cell metabolism; and the disturbance of the cellular genome resulting in the transmutation of a benign neoplasm into a cancer cell metabolism. In addition, we also describe the mechanism of inflammation, as well as other diseases mechanisms. There is also the new possibility of efficient cancer treatment through targeting of the mechanism of the Warburg effect by prolonged medical starvation (42–45 days) supported by herbal extracts and weakly

cytotoxic substances at very small doses. We have substantiated and elucidated the mechanism of resistance to cytotoxic drugs and cancer relapse after use of modern methods of cancer treatment, which make use of large doses of cytotoxic drugs. This also proves the advantage of the described new method of cancer treatment over modern methods of chemotherapy with large doses of cytotoxic drugs.

Interactions between human organism and its surrounding are supported by mechanisms of human mentality which biophysical mechanisms are described. Besides taking into account the mutual interactions between the internal energy stability of the mechanisms of open thermodynamic systems in living organisms and the thermodynamic system of the atmosphere, we consider these interactions from the point of view of maintaining the stability of these thermodynamic systems, according to the famous Prigogine's theorem. Thus, we have made some assumptions: the flows of exchange of anabolic energy between human organisms and the atmosphere due to the cycle of life and death can be identified as the movements of human "souls" with the life and death of organisms, i.e. the possible immortality of the human "soul" can be proved by Prigogine's theorem.

CHAPTER 1

THE ROLE OF SOLAR THERMONUCLEAR SYNTHESIS IN FORMING THE SOLAR SYSTEM AND LIFE ON EARTH

1.1. Introduction

The influence of the environment on the life and health of human organisms was observed and estimated from the point of view of thermodynamics. There are mutual influences between the environment and the existence of life on Earth. These mutual influences result in the stability of the open non-equilibrium non-linear thermodynamic system of human organisms along with other organisms, as well as the stability of the thermodynamic system of the atmosphere, which constitutes the environment of organisms. The processes active in the environments of the troposphere, the ionosphere, the Solar System, and even the galaxy are crucial productive factors driving dynamic interactions between the open non-equilibrium non-linear thermodynamic systems of organisms and the open thermodynamic system of the atmosphere. The mutual exchange of energy and substances between the open non-equilibrium non-linear thermodynamic systems of living organisms, including human organisms, and the thermodynamic system of the atmosphere determines the stability of the internal energy of human and other organisms, as well as the stability of the internal energy of the atmosphere, corresponding to the first law of thermodynamics and according to the famous Prigogine's theorem. The mechanisms that ensure the stability of both the internal energy of organisms and the internal energy of the atmosphere operate through the ways that the states of an organism link up with the state of the atmosphere via the exchange of energy and substances. These mutual exchanges of energy are subjected to the activity of the Sun, and even that of the galaxy. The exchange of energy between organisms, including human organisms, the atmosphere, and the Solar System are displayed by

the mechanisms that preserve the stability of internal energy in these thermodynamic systems. In addition, the Solar System influences the regulatory mechanisms of internal energy and the internal medium of the human organism. These relationships are indicators of flows of energy and substances, which generate internal energy stability in these systems. These ineradicable flows of energy make it possible to identify the flow of energy with the flow of the soul after the death of an organism, which acknowledges the immortality of living souls between the life and death (see Chapter 2 /2.3, 2.3.1/).

1.2. The Mechanism of Maintaining Internal Energy Stability in the Thermodynamic System of the Sun

The dissipation of solar energy results in the flow of thermal energy as light rays. The formula for the second law of thermodynamics is:

$dS = dQ / T$ (S – entropy; Q – heat in calories; T – temperature in kelvin), i.e. an increase in heat (Q) defines an increase in entropy (S). Thus, entropy reflects the level of energy dissipation in the Solar System, through temperature in kelvin (K).

Thus the mechanism of internal energy stability in the thermodynamic system of the Sun reflects the balance of dissipation and absorption of energy through the accumulation of energy by substances with a certain mass, according to Einstein's formula: $E = mc^2$ (E – energy; m – mass; c – the speed of light); and it promotes the maintenance of the stability of the stationary state of the thermodynamic system of an organism according to the first law of thermodynamics: $H = U + W$ (H – enthalpy; U – internal energy; W – work of the thermodynamic system).

A reversible change in heat ($dQ_{reversible}$) prevents the increase in entropy (S) of the Sun corresponding to the following formulas of the second law of thermodynamics as shown in the following:

$dS = dQ_{reversible} / T \leq dQ / T$, i.e. either $dS = dQ_{reversible} / T$ or $dS < dQ_{reversible} / T$. As such, the incomplete reversible change of heat ($dQ_{reversible}$) leads to $dS = dQ_{reversible} / T$, but the complete reversible change of heat ($dQ_{reversible}$) results in $dS < dQ_{reversible} / T$.

The reversible change in heat ($dQ_{reversible}$) occurs via solar thermonuclear synthesis and processes of nuclear fusion and fission with the dissipation of solar energy via solar rays of different quanta. A balance between fission and fusion promotes the stability of the internal energy of the Sun's thermodynamic system and both processes occur simultaneously in its core. The proton-proton chain reaction starts at temperatures of about 4×10^6 °K, with fusion initially being the dominant process, using a mechanism focused on forming hydrogen, due to its small nucleus, and then transiting to helium (1). Following on from this, we find nuclear fusion focused on substances with larger nuclei and where two or more atomic nuclei come close enough to form one or more different atomic particles of nuclei and subatomic particles (neutrons and/or protons). The difference in mass between the products and reactants is manifested in the release of large amounts of energy. The difference in mass arises due to the difference in binding energy between the atomic particles of the nuclei resulting in the transformation of energy into mass according to Einstein's formula ($E = mc^2$). The dissipation of solar energy creates high solar temperatures of about $4x10^6$ °K, displaying an increase in entropy (S) corresponding to data on the second law of thermodynamics, i.e. increased fission versus nuclear fusion. However, the dissipation of solar energy also creates light rays, also with high solar temperatures. Therefore, we assume that nuclear fusion occurs due to the operations of light rays together with high solar temperatures. The role of light rays in the growth of plants and insects (beetles, flies, etc.) in spring is well-established. Even in the artificial conditions of a greenhouse, light rays promote synthetic processes of the cell cycle for the growth of plants and insects. Solar light rays also have an influence on the human organism in relation to the synthesis of important substances, e.g. the synthesis of vitamin D_3 through the operation of solar ultraviolet rays, which prevents rickets. All of this occurs in the completely reversible change in heat in the Sun when $dQ_{reversible}$ leads to $dS = dQ_{reversible} / T$. However, an incomplete reversible change in heat happens more often when $dQ_{reversible}$ leads to $dS > dQ_{reversible} / T$. We suppose that the Sun receives energy from cosmic dark matter to replenish lost energy from the accumulated energy of the planets of the Solar System, including Earth.

1.3. The Mechanism of Solar Thermonuclear Synthesis

The main reaction within the core of the Sun is the proton-proton cycle. Proton-proton chain fusion occurs as a result of the enormous pressure and temperatures of about $4x10^6$ °K (1–3). Corresponding to the proton-proton chain reaction, hydrogen nuclei are converted into helium nuclei through a number of intermediates. This energy conversion is described by Einstein's famous equation: $E = mc^2$. The energy created by fusion within the core of the Sun exerts outward pressure, which keeps the Sun from collapsing in on itself. Concomitantly, the inward pressure keeps the Sun from exploding, which causes gravitational attraction in the gas mantle surrounding the core. The combination of outward and inward pressure results in the consumption of energy under conditions of sufficiently high temperature ($4x10^6$ °K), driving fusion processes of thermonuclear synthesis versus fission processes that dissipate solar energy (1–3). The next set of processes constitute the CNO (carbon-nitrogen-oxygen) cycle, which is a catalytic cycle. In the CNO cycle, four protons are fused using carbon, nitrogen, and oxygen isotopes as catalysts to produce one alpha particle consisting of two positrons and two electron neutrinos (1–5). Although there are various pathways with catalysts involved in CNO cycles, all of them have the same net result. The positrons are annihilated almost instantly by electrons, releasing energy in the form of gamma rays (1–6). The neutrinos escape from the star carrying away some of the energy. Some nuclei go on to become carbon, nitrogen, and oxygen isotopes through a number of transformations, which take place in an endless loop. Compared to the proton-proton cycle, the CNO chain starts at a temperature of approximately 15×10^6 °K, and the production of energy increases rapidly with increasing temperature (1–8). At approximately 17×10^6 °K, the CNO cycle starts to become the dominant source of energy (1–8). The temperature of the Sun's core is around 15.7×10^6 °K and the majority of nuclei are born in the CNO cycle (1–8). Fusion reactions have an energy density many times greater than nuclear fission. Such fusion reactions produce a great quantity of energy per unit of mass, though individual fission reactions are generally much more energetic than individual fusion reactions, which are millions of times more energetic than any chemical reaction (1–8). However the fusion

processes release energy, producing atoms lighter than iron-56 or nickel-62. The nucleus of each atom consists of protons and neutrons, which are contained in a nucleon having two different alignments of particles “u” and “d”. The distribution of these particles determines the positive functions of protons and the neutral function of neutrons in the nucleus of an atom, while also determining the atomic weight. The charge of the proton defines the distribution of these particles, forming positive charges caused by the inserted positrons. Thus, rays of solar energy form opposite charges in atoms as positrons and electrons. These atoms build up substances, which can create a gaseous medium, a liquid medium, and a solid medium. These mediums are affected by temperature, i.e. the temperature determines whether a medium is gaseous, liquid, or solid. A gaseous medium occurs at a stable atmospheric air temperature of -40 to +40 °C, which is also the optimal temperature range for eukaryotic and prokaryotic organisms. A liquid medium occurs at the atmospheric temperature of water from 0 to +4 °C, considering the polarity of water (H_2O). However, the temperature of the gaseous medium in the inner core of Earth is about 5,200 °C with a pressure of about 4 million atm and no biological organism could survive in such conditions. The gaseous medium in Earth’s inner core consists of molten quartz with silicon, along with a number of heavy metals of different masses arising from periodic cataclysms such as volcanic eruptions, hurricanes, and earthquakes etc.

We assume that the mass of the earth’s core was formed from part of the mass of the Sun after its formation. This mass was generated by the accretion of compounds with high melting points and rocky silicates (silicon, aluminium, magnesium, and sodium etc.), which were subjected to oxidation to form silicon dioxide (SiO_2) and others. Thus, once cooled, the molecules formed Earth with its inner core having a temperatue of about 5,200 °C and a pressure of about 4 million atm. The energy of the core is replenished by solar energy, magnetizing it and exerting movement around the Sun due to its opposed outward directional force. Thus, the earth is subjected to two sources of heavy energy. The earth also has permanenntly cold zones around the North Pole and South Pole, as well as a permanently hot zone around the equator. The existence of Earth is supported by the balanced expression and suppression of entropy,

corresponding to Boltzmann's formula, which explains entropy according to the second law of thermodynamics. Boltzmann's formula ties entropy (S) to thermodynamic probability (ω): $S = k_B \ln \omega$ (Boltzmann constant $k_B = 1.38 \times 10^{-23}$ J/K).

Entropy determines how each macrostate of the thermodynamic system of an atom is realized via the great quantity of microstates in it. The total breakdown of a macrostate into a quantity of microstates leads to the annihilation of matter, transitioning to a temperature of absolute zero degrees kelvin, which is equal to minus 273.15 degrees celsius (0 °K = -273.15 °C). Unfortunately, the maximum positive temperature that leads either to complete entropy with the complete annihilation of matter, or to thermonuclear synthesis suppressing entropy due to the impact of fusion remains unknown. Therefore, a combination of sufficiently high thermal energy (Q) and a different negative wavelength of solar radial energy forms various simple inorganic ions and molecules that correspond to the thermodynamic probability of Boltzmann's theory. Some elements are formed by the pressure inside the earth acting on silicon (Si), in the form of silicon dioxide (SiO_2), which creates terrestrial pressure and high temperatures, promoting the formation of minerals like anthracite coal and petroleum etc. Thus, the open thermodynamic system of Earth is subjected to fluctuations in the balance between the macrostate and microstates, with shifts towards increased or decreased microstates, i.e. the balance between the expression and suppression of entropy.

Thus, quanta of solar rays, in relation to thermonuclear synthesis, form inorganic atoms in the ionosphere and the atmosphere. However, atoms with nuclei heavier than iron-56 or nickel-62 absorb and accumulate energy from solar thermonuclear synthesis deep within the earth. These elements have the largest binding energy per nucleon.

The fusion of light elements with these heavy elements releases energy, resulting in an exothermic process. This is because fusion produces nuclei that are heavier than these elements, retaining energy by forming nucleons, and thus these reactions are significant endothermic processes. The opposite reaction is engaged for the reverse process of nuclear fission. This means that lighter elements, such as hydrogen and helium, generally

display greater fusibility. In contrast, heavier elements, such as uranium and plutonium, are more fissionable. Thus, we suppose that most of elements with a nucleus heavier than iron-56 or nickel-62 have played a role in creating the planet's minerals due to the great pressure in the planet's core.

There are also connections between solar energy processes and energy processes in the core of the earth, resulting in earthquakes, tsunami, volcanic eruptions, and hurricanes etc. All of this maintains solar energy processes that have an impact on the core of the earth. In addition, solar thermonuclear synthesis via fusion processes in the proton-proton cycle and the CNO cycle forms the ionosphere and the atmosphere. The ionosphere consists of electrons and electrically-charged atoms and molecules, i.e. ions, which transfer supplementary energy, exchange energy and substances between the atmosphere and Earth. Ultraviolet, X-ray, and solar radiation of short wavelengths are ionizing radiation. Photons at these frequencies contain sufficient energy to dislodge an electron from a neutral gas atom or molecule upon absorption. In this process, the light electrons develop high velocity so that the temperature of the created electronic gas is much higher (thousands of degrees kelvin) than the temperature of the ions and neutral atoms. Recombination is the reverse process of ionization, in which a free electron is captured by a positive ion. Recombination occurs spontaneously and causes the emission of a photon, which carries off the energy produced. Where gas density increases, recombination prevails, since the electronic gas and ions are attracted to each other (1–12). The balance between these two processes determines the quantity of ionization. All of these phenomena occur simultaneously, along with disturbances such as solar flares and associated releases of charged particles into the solar wind, impacting Earth and interacting with its geomagnetic field (1–12). Mechanisms that maintain internal energy stability occur via the balance of fusion and fission processes in the solar core.

1.4. The Role of Solar Processes in Forming both Non-living Substances and Living Organisms

The stability of internal energy achieved via the balance of fusion and fission processes in the Sun's core results in balanced thermonuclear synthesis through inward pressure and the dissipation of thermal energy into the broader environment via outward pressure. The pressure and temperature in the solar core is high enough to force the development of both fusion and fission, which are nuclear reactions through which some nuclei merge into the Sun. These nuclear reactions form units of energy, which are distributed as energy quanta corresponding to the Plank constant, $h = 6.62607015x10^{-34}$ J/s, or the reduced Plank constant ($\hbar = h/2\pi$) with the value $\hbar = 1.054571800\times10^{-34}$ J/s (J – joules; s – second) (13, 14). In addition, these particles of energy quanta are formed simultaneously as synthesized nuclear particles via the concentration of energy according to Einstein's formula ($E = mc^2$ and $m = E/c^2$), as well as the dissipation of radial thermal energy, which causes solar radial waves (13, 14). This radial energy reflects the fusion processes of solar thermonuclear synthesis, as well as the fission processes of solar nuclear thermal dissipative energy (13, 14).

The dissipation of thermal energy at very high temperatures into the environment cause waves of radial energy, which have far higher wavelengths than infrared radiation and far lower wavelengths than ultraviolet radiation, generating positive particles due to the presence of positive energy quanta, as well as negative particles due to the presence of negative energy quanta. The waves of positive radial energy can induce the synthesis of positive particles in atomic nuclei. They also have the capacity to induce the synthesis of negative particles in the electron layers (K, L, M, N, O) and electron orbits (s, p, d, f), in which one radial energy quantum forms the layer number and the other radial energy quanta form the orbital quantum numbers. This results in the filling of both orbitals and layers with electrons for synthesized atoms by waves corresponding to positive and negative radial energy. Hence, with high enough pressure of thermal energy (Q) and energy of different wavelengths, photochemical reactions are stimulated that form simple inorganic ions and molecules like H_2, O^{-2} and O_2, N_2, CO_2 etc. in the ionosphere and atmosphere (15).

Additionally, waves of radial negative photons knock electrons out of semiconducting photoelectric cells, realizing the photoelectric effect of electric current.

The differential of thermal energy equals the differential of entropy multiplied by the temperature (in kelvin) and corresponding to the second law of thermodynamics: $dS = \delta Q_{revers.} / T \leq \delta Q / T$; or $dQ = TdS$ (S – entropy; $Q_{revers.}$ – thermal reversible energy; Q – thermal energy; T – temperature in kelvin). Some elements have been formed in planet Earth, such as silicon (Si), existing as silicon dioxide (SiO_2), which was created via great terrestrial pressure and high temperatures deep within the core. Terrestrial pressure and high temperature also promote the formation of minerals such as coal and petroleum etc. Thus, solar gravitation influences the activity of planet Earth, especially its core, sometimes driving orogenesis.

Being subjected to the thermodynamic probability of Boltzmann's theory, a combination of sufficiently high thermal energy (Q) and negative energy of different wavelengths results in the formation of different combinations of covalent and ionic bonds in the organic molecules of living organisms. For example, the role of sunlight in the synthesis of vitamin D_2 (ergocalciferol) is well known. Energy from ultraviolet rays of wavelength 290–315 nm promotes the transition of 7-dehydrocholesterol into previtamin D_1; previtamin D_1 is converted into previtamin D_3; and previtamin D_3 is finally converted into vitamin D_2 (16). In addition, waves of radial energy, particularly ultraviolet rays especially, promote greater activity in biological life during springtime, including various beetles, maybugs, flies, and other insects, as well as viruses, which cannot live independently of living organisms because they do not have their own respiratory systems. Furthermore, it is known that ultraviolet rays of wavelengths lower than 200 nm possess carcinogenic properties and can induce oncogenesis causing viral oncogenes (v-oncogenes) to affect cells (16). This also means that ultraviolet rays can promote proliferative processes of biological life.

1.5. Solar Radiation Germinates Living Entities and Engages Processes of Germination in Prokaryotic Organisms

Exhibiting a solar balance of fusion and fission, the solar radiation of positive and negative energy drives activities involving compound substances, as well as simple substances. This action corresponds to a balance between the increase and decrease in entropy according to the second law of thermodynamics. Indeed, a balance between the fusion and fission of radial energy induces a balance between positive and negative particles and between positively charged and negatively charged ions. The specificities of a balanced distribution of decreased entropy and increased entropy influence certain biochemical and biophysical processes, stimulating the production of compound organic and inorganic molecules and corresponding to the quanta of radial energy according to Boltzmann's theory and Einstein's formula. Thus, it was the action of solar radial energy that resulted in the formation of a solid planet Earth and the gaseous medium of the atmosphere along with the substances produced in them.

The maintenance of stability of the internal energies and mediums of the atmosphere and planet Earth promotes the germination of living organisms as open thermodynamic systems. Exchanges of energy and substances between the thermodynamic systems of living organisms and the thermodynamic system of the atmosphere promote the stability of internal energy in these systems, as substantiated by Prigogine's theorem (see below). This means that the balance of fusion and fission induces special quanta of radial energy, which promote germination processes of living matter and engage the reproductive processes of prokaryotic organisms, which also influence eukaryotic organisms. The processes of germination for simple prokaryotic organisms like viruses and bacteria occur under the constant influence of solar radial energy. Solar radial energy causes oscillations with a moderate decrease or a moderate increase in entropy, promoting anti-apoptotic and pro-apoptotic processes in living organisms, respectively.

Viruses are the smallest infectious agents. They germinate and replicate only inside the living cells of more complex organisms. This is because