Causal Relation Between Emotional and Oxidative Stress - an Integrative Approach

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Abstract

The study presented in this dissertation underscores the existence of causal relation between emotional stress and cellular oxidative stress and posits the statement that improvement in quality of emotions reduces oxidative stress. To support this statement, the following experiment was conducted in my medical practice. Fourteen participants who volunteered for my study, recognized presence of stress in their lives and expressed willingness to learn how to lessen or eliminate its negative effects. As a stress reducing tool, I used emWare Stress Relief System developed by HeartMath Institute because of its scientifically proven effectiveness in reducing stress. Additionally, its biofeedback properties, greatly enhanced participants engagement and its data analysis added credibility to the conducted process and objectivity to the results obtained. To indirectly assess the degree of oxidative stress in the body I monitored Erythrocyte Sedimentation Rate (ESR) levels before and after emWare stress reducing sessions. I chose to monitor the levels of ESR because of its linear (Newtonian) and multidimensional (quantum) properties. The conclusions were made based on information gathered from the following data: Ardell Stress Test scores, emWare Stress Relief System data and dynamics of Erythrocyte Sedimentation Rate. The following logic was used to come to conclusion. Red blood cells being quantum mechanicals, are highly responsive to our emotions and react to positive emotions by reducing the rate of oxidation. This reduction of oxidative stress in the blood is reflected by reduced levels of ESR. After analysis of my data, small but significant reduction of Erythrocyte Sedimentation Rate was demonstrated in 10 out of 14 participants following reduction of stress, which translated into reduced level of oxidative stress.

Dedication

To ever-present gentle and intelligent soul of my mother, Danuta Kibilska.

Acknowledgment

I am eternally grateful for the true love of my husband Walter and his unconditional support throughout my entire journey of becoming an integrative physician.

I feel indebted for the privilege of being taught by the two greatest minds in the field of Integrative Medicine - Dr. Paul Drouin and Dr. Amit Goswami.

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Chapter 1: My Journey From Why Medicine to Why Quantum Medicine?

My story started in the early nineteen fifties. Poland, badly destroyed by Russian and German invasions of the World War II, was just starting to rebuild its land and its nation. Young woman, who survived the horror of occupation, was anxiously expecting the birth of her first child. She was happy but nevertheless troubled by growing concern of not gaining weight like all healthy pregnant women do. Not only she was not gaining any weight, she was losing it. After visit at the local clinic, she was diagnosed with pulmonary tuberculosis. This mostly air-born disease was not that uncommon in young adults at that time of war. Their immune system weakened by years of malnutrition was not a match for this virulent mycobacterium tuberculosis. Young woman considered herself lucky. In spite of illness, she gave birth to her first child, a little boy. After delivery, anti-tuberculosis treatment was started. There were only three drugs available at that time for this disease. Unfortunately, they were not very effective and the *acid-fast bacillus* was slowly destroying her lungs and her vitality. She was advised by her doctors not to get pregnant but four years later she became pregnant again. She was offered an abortion but chose to continue with her pregnancy against medical advice. Nine months later she delivered a healthy girl - me.

Even in the years of my early childhood, I never remembered my mother being healthy. She always looked fatigued and was short of breath, even on minimal exertion. Seeing my mother struggling to catch her breath made me feel fearful and helpless. Those feelings must

have accelerated my emotional maturity and I quickly became less of her child and more of her caregiver. I clearly remember my trips to the local food store. I was about 4 years old then. I could not have been older since I still could not read. My mother would give me a shopping bag, a grocery list and some money, which I kept tightly in my hand in fear of losing it. The store was a short walk from home but it did require crossing the street. I would hand the list to the store owner, who would pack everything in my shopping bag and took whatever amount of money he needed from my hand. Just like that! I was quite used to doing different chores and errands but deep inside I desperately wanted to do for her something much more meaningful. Then, at the age of eleven I found a solution. I decided to become a doctor. The desire to heal my mother was my driving force to study diligently in grammar and high school. It paid off. After taking the arduous 3-day entrance exam, I was admitted to the most prestigious Medical University in Poland. I was in seventh heaven. I was absolutely certain, that the knowledge I was about to gain in the next six years of medical studies was holding the key to restoration of my mother's health. Years were going by and I was passing exam after exam. Hundreds of sleepless nights studying, pre-exam jitters, countless hours spent in different hospitals learning hands on how to be the best doctor I could possibly be. All for "nothing". Within a few months of receiving my medical diploma, my mother died at the age of 54. I was heart-broken way beyond the loss of a parent. I felt I let my mother down. I felt I let myself down, this once eleven-year-old child, whose belief in the healing power of medicine somehow never materialized the way she imagined it would.

Then life moved very quickly for me, I married the love of my life, who was an American studying medicine in Poland, and a few weeks after my mother's passing, I immigrated to the United States. These were my early eighties. In the next six years I did my residency in Internal Medicine, passed whatever exams were required of me, gave birth to four children, and together with my husband opened our Internal Medicine practice. We kept the size of the practice reasonably small to give us a chance to enjoy each other and spend time raising the children.

From my very first encounter with American medicine, I noticed how much more advanced it was compared to medicine in Poland. With ache in my heart I could not stop thinking that if my mother was in the United States, she probably would still be alive. Regretfully I could not change the past. What I could do is use the experience of my past as a force to propel me forward. After all, this was my vocation. I was a medical doctor with the passion to heal. So, I used my knowledge and my passion, to heal somebody else's mothers, fathers, sons, and daughters to the best of my abilities. The combination of my skills, inexhaustible supplies of pharmaceuticals, easy hospital access, and usage of widely available sophisticated diagnostic tools undoubtedly prolonged lives of thousands of patients who were put on my path by the grace of God. Years were passing by, and I immensely enjoyed our laid-back practice setup. Small patient load kept the familiar physician "burn out" at bay and gave me time to develop deeper and more meaningful relations with my patients and their families. I seemed to be happy and fulfilled in my profession. Then, the familiar feeling from my younger years started to resurface again. The feeling, that in spite of all I was doing, I was somehow letting my

patients down. It most likely stemmed from my realization and awareness that as great as contemporary healthcare was, it did have some concerning limitations. The patients were living longer, but their longevity came with a price, which was a very long list of chronic and frequently debilitating diagnoses. Constant pain arising from degenerative joint disease, which a majority of my older patients had, was not responding to any over the counter or prescription medications, not even opioids. Progressive dementia was robbing many from their identity, creating at the same time an enormous burden on unprepared for this situation family members. Younger patients were getting sicker much earlier than I expected. Life in general was perceived by them as competitive, hostile, and overall stressful. As a result, I noticed a significant increase in occurrence of obesity, diabetes mellitus, digestive problems, anxiety, depression and many others which were clearly related to stress. Medications in most of these conditions were not curative. This situation started to concern me quite seriously, considering the fact that my number one weapon was my prescription pad. I became determined to find new ways to help my patients to live better and healthier lives. As Buddha once said "when student is ready, the teacher will appear". My new teacher, Quantum University helped me find what I was looking for - a better, more wholesome way to heal; a healing that goes far beyond that what I have learned in my medical school. I became an integrative doctor, ready to practice integrative quantum-based medicine.

So, what is this quantum medicine? Where did it come from? Is it a new fad similar to the ever-changing kaleidoscope of miraculous diet endorsements? Is it quackery? a scam? or a real science producing real healing? Before any questions related to healing either in

conventional or quantum model of medicine can be answered, the basic principles of physics must be understood.

Chapter 2: Evolution of Physics

Medicine is the study of the human body for the purpose of healing. We are made of atoms like the rest of our universe. Our bodies on every level function according to the laws of physics. From gravitational forces which prevent us from flying off the Earth, through shear mechanics of musculoskeletal system, all the way to quantum-based mind-body connections, all of these wonders are governed by prescriptive universal laws which physics is constantly studying and applying. Physics and medicine therefore go hand in hand. It is our obligation as physicians to master and apply the knowledge of continuously being discovered laws of physics for our own benefit and the benefits of our patients.

What is Physics? Physics is the study of the world, of matter and energy, and the relation between them. It comes from a Greek word “phýsis” which translates as “the order of nature”. Its primary objective is to understand what nature is, and how it works (Zitzewitz & Neff, 1995, p. 4). This studying of nature is not meant to be an esoteric activity but has its deepest purpose in the ultimate understanding of the relation we humans have with our universe. After all, it is our incessant curiosity about the world which has brought us to the present understanding of reality. Looking back to the beginning of physics, we can distinguish three subsequent periods

which presented us with three unique physical explanations of the universe. These are: Aristotelian physics, classical or Newtonian physics and quantum physics (Jaki, 1970, p. 4). Looking at all three of those eras, one can only marvel at the power of this knowledge and its influence on evolution of our consciousness.

Organismic Model of Aristotelian Physics

The question about what the world is made of, intrigued some Greek philosophers back in the fourth and fifth centuries BC. The Greek way of looking at nature asserted itself as a leading principle of the study of nature. The most detailed formulation of this approach was presented by Aristotle in his books on Physics and Metaphysics (Jaki, 1970, p. 9).

Aristotle (384-322 BC) was a physicist and philosopher, intuitive observer and logical thinker. He used observation and logic as instruments for understanding reality. He is known today as the father of physics and the father of logic. For Aristotle, nature was understood as something like man himself - moving towards goals and striving towards the best possible arrangement. In short, nature was acting like an organism. His approach to nature was clearly holistic. He stressed the priority of the whole over its parts, and unity between man and nature in an organic whole (Jaki, 1970, pp. 13-15).

Aristotle believed that our universe was created. His concept of creator of the universe was called the Unmoved Mover who is the primary cause, or mover, of all the motion in the universe. In book XXII of Metaphysics, he described the Unmoved Mover as being perfectly

beautiful, invisible, contemplating only the perfect contemplation. Unmoved Mover was also eternal, indivisible and without parts, states book VIII of Metaphysics. The first things to be moved – celestial bodies, are not moved by contact but by love and aspiration. In other words, Aristotle believed in a creator of universe who is love.

Aristotle believed that body was not alive by virtue of its structure. He believed in soul. Soul was a substance which was pure form. It was lacking matter and at the same time was a source of all life. Primary matter on the other hand was made out of the primordial four elements - earth, water, ether and fire. This theory that physical objects are not just physical but a mixture of matter and immaterial form is known as hylomorphism. It was Aristotle's form which was the actual, active determining principle. It was a first actuality of a natural body which had life in potentiality. The potential principle was matter. Aristotle saw in the universe potentiality existing for the sake of actuality (Sampaolo, 2016).

Aristotle believed that high complexity and efficiency of biological organisms was such that they could not possibly come into being at random. In Books 3-4 of Fundamental Concepts of Nature, Aristotle stated that all nature had teleological meaning; it was organized towards a final end. He believed that all natural things had not only form and matter but also a purpose. Chance, he stated, does not repeat things in a regular fashion. Regularity can only be assigned to purposeful action (Jaki, 1970, p. 14).

Aristotle showed us how powerful the gift of observation and logic could be in understanding reality. His concepts of unity between man and nature, creation of universe with a

purpose, and primary matter existing in potentia were found to be in conformity with the laws of quantum physics, twenty-five hundred years later.

Mechanistic Model of Newtonian Physics

Aristotelian ideas of an organismic world were embraced by almost two millennia, but lost its credibility during the next era in physics – Newtonian physics (Spitzer, 2010, p. 3).

Human fascination with a timeless question, how does the universe work, propelled a multitude of minds towards making new observations and exploration of new ideas about surrounding reality. Some of those ideas were so extraordinary that collectively they contributed to what is known as the Scientific Revolution of 17th century.

It was triggered by Polish astronomer Nicolaus Copernicus (1473-1543). In his book "On the Revolution of Heavenly Spheres" published in 1543, Copernicus presented his heliocentric theory which directly challenged universally accepted Aristotle's geostatic view of the universe. Copernicus with his discovery boldly "displaced" Earth from the center of universe to a mere orbit around the Sun.

Another scientist Galileo Galilei (1564-1642) - avid supporter of heliocentrism proposed that knowledge should be based on observation and experiments, and himself developed a systematic method of observation, experimentation and analysis (Zitzewitz & Neff, 1995, p. 9). Knowledge of mathematics expanded rapidly endowing us with a mathematical understanding of

the natural world. This ability to describe physical laws using mathematics caused a shift in scientific focus from quality to quantity. Galileo himself uttered the following statement, "*mathematics is the language in which God has written the universe"* (Galileo Galilei).

Completion of the Scientific Revolution was attributed to Isaac Newton (1843-1727) - an English physicist and mathematician. His input into what became to be commonly known as classical mechanics was tremendous. He was the inventor of the law of universal gravitation which he derived from empirical observation. His gravitational force was connected with the bodies it acted upon and travelled through space instantaneously. With this law, Newton solidified Copernicus's theory of heliocentricity, and in a way unified heaven and earth, claiming that the same force which caused an apple to fall to the ground, also held the planets together. Newton also became the inventor of three laws of motion which together with his gravitational law laid the foundation for classical mechanics. These laws Isaac Newton described in his book *Philosophiae Naturalis Principia Mathematica*, first published in 1687. They were to dominate physics for the next three centuries (The Scientific Revolution).

Wide acceptance of Newtonian physics fundamentally changed scientists and philosophers' view of reality. Aristotelian vitalism based on the premise that vital force was a necessary factor for existence of life, had been replaced with a mechanistic materialism claiming that all life phenomena can be completely explained by the same physical and chemical laws that govern the inanimate world (Magner, 2001).

One of the most prominent thinkers of this era who became very influential in solidifying this shift from vitalism to mechanism was René Descartes (1596-1650). He was a French philosopher, mathematician and the author of the famous *"Cogito Ergo Sum"*. In his views, he made the point to set himself apart from previous philosophers, especially Aristotle, and he succeeded. First, he split Aristotelian's duo of observation *and* logic, used as a tool for understanding reality, by discrediting the objectivity of knowledge gained through our physical sensations. He claimed that the only source of knowledge is the rational mind (Rene Descartes). In other words, just thinking was enough to gain all knowledge. This was the beginning of Descartes' "rebellion" against the great Aristotelian mind. The next notion Descartes rejected was Aristotle's hylomorphism – the theory that physical objects are a mixture of physical matter and immaterial form. Contrary to Aristotle, he viewed the mind as being totally separated from its physical body. Not only were the two separates, but were made of two different substances, he said. In relation to property of matter, Descartes was a mechanist. In his "Treatise of Man" he banned vitalism in any form whatsoever. As he put it, the body of man was "*a machine made of earth*" and all the functions *"follow naturally in this machine simply from the arrangements of its parts, no more and no less than do the movements of a clock or other automata"* (Jaki, 1970, p. 285).

From that point on, cartesian dualism replaced Aristotelian hylomorphism and the "*machines were to be idolized with as little second thought as had been the concept of organism for over two thousand years"* (Jaki, 1970, p. 51).

Newtonian model of reality is truly a physical one. This reality can only be experienced with our five senses. Objects are made of solid, un-destructible matter and exist in three-dimensional infinite empty space (Goswami, 2004, p. 55). These objects are independent of space. They are described as localized, because they occupy certain place in space and time. All interactions between objects are also local and require exchange of energy and signal, which travels through space in a certain amount of time. Time, similarly to space, is a separate dimension. It is independent of the material world and flows at the even rate (Capra, 2013, p. 161). This space-time reality is the foundation of classical physics (Dispenza, 2017, p. 220). Newtonian physics is based on predictable outcomes. It is a realm of known and predictable. All movements are continuous and determinable by mathematics. Energy is continuous as well.

In summary, Newtonian physics was characterized by determinism, locality, predictability and continuity of movements.

Probabilistic Model of Quantum Physics

By nineteenth century scientific world was quite familiar with the behavior of matter on the macroscopic level, which could be seen, heard, smelled, tasted and touched. The desire to know and understand more about reality remained strong amongst curious minds and eventually lead to many new groundbreaking discoveries.

One of those curious minds was John Dalton (1766-1844) – an English chemist and physicist. He decided to look deeper into the matter and as a result of his experiments, postulated a theory that matter was made of very tiny invisible and indivisible elements which he called atoms. This term was first used by ancient Greek philosopher Democritus, who back in fourth century BC believed that everything in universe was composed of atoms (Ross, 1998). These atoms would form compounds by combining in whole-number ratios. Dalton's discoveries were known as modern atomic theory.

The search into newly discovered atoms continued and determined that atoms although indeed invisible were actually further divisible. In the year 1897, British Physicist J.J. Thompson (1856-1940) discovered the electron - first subatomic particle of the atom.

The atomic theory got further refined by another British physicist Ernest Rutherford (1871-1937). Rutherford discovered that atoms have centrally located nucleus which was positively charged and accounted for all atomic mass (Trasancos, 2016).

All these exciting discoveries brought scientists to sobering realization that the reigning theory of Newtonian physics was inadequate to describe this newly discovered atomic world. As soon as physics reached the layers of atoms the rigidly defined Newtonian concepts of nature needed to be revised. Laws of classical mechanics were not accurate while dealing with atomic size objects and high velocities of subatomic particles **(**Jaki, 1970, p. 93**)**.

For the purpose of further exploration of this atomic reality, completely new set of laws had to be formulated. They were named the laws of quantum physics.

The word *quantum,* which in Latin means *something that has quantity* was introduced to physics by German physicist Max Planck (1857-1947), the discoverer of so-called energy quanta. Matter at the atomic level stated Planck, gained and lost energy in quantized form (Zitzewitz & Neff, 1995, p. 556). Today we know that not only energy but also time and space have a minimum quantity called *quantum* (Chevalier, 2007, p. 5). The discovery that energy is quantum, directly contradicted Newtonian view of energy being continuous (Stuewer, 1998).

Then Niels Bohr (1885-1962) - Danish physicist developed his planetary model of the atom which became scientific sensation in a year 1913. It depicted atom as having centrally located nucleus with orbiting electrons. The movement of the electron on its orbit was continuous. According to Bohr's however, when electron jumped from one orbit to another, it did it in *discontinuous* way. It did not go through the intermediate space but simply disappeared from one orbit and reappeared on another one. This discontinuous movement of particles like electrons was called *quantum leap* (Goswami, 2004, p. 63**)**.

Another important aspect of quantum physics, also discovered by Niels Bohr, were *non-locality*, and quantum *entanglement*. It posited, that once subatomic particles like protons and electrons were in contact with each other, they remain aware of each other whereabouts even if they became separated by intergalactic distance. Not only were they aware, they were able to influence each other instantaneously and indefinitely; they stay entangled. They exchange information which was non-local and instantaneous.

Next developments in quantum physics became even more intriguing when French physicist Louis de Broglie (1892-1987) after further studying the nature of electrons, came up with revolutionary theory of *wave-particle duality*. De Broglie posited that matter on the atomic scale might have wave properties. The famous *double slit experiment* showed that electron (or other particles of matter) could indeed be either wave or particle. This new property of matter discovered in atomic world was surely impossible to reconcile by Newtonians laws of matter. (Jaki, 1970, p. 93). Newtonian objects could only have wave properties or particle property, never both. On atomic level, wave and matter functions indeed turned out to be complementary descriptions of the same reality. This principle was proposed by Niels Bohr and named *complementarity* (Capra, 2013, p. 159).

Newly discovered atomic world with its own peculiar set of rules was surely turning physicist heads - sometimes in awe, sometimes in disbelief. Principles such as discontinuity, complementarity, uncertainty, entanglement were mathematically described by the wave function which only showed probabilities instead of specific solutions. The matter became fuzzy and no longer clearly defined. In spite of that new knowledge, physicists were still unwilling to give up the idea of the world made out of building blocks, so they continued to split atoms in order to find that one particle which supposedly started it all. With an aid of particle accelerators over hundred subatomic particles were discovered and the list keeps growing. But once the physicists got to the bottom layer of matter, there was nothing really material there. Once they entered the subatomic world of nuclear particles, even quantum mechanical principles were not enough, because those particles moved with the speed approaching the speed of light. According

to Albert Einstein theory of relativity: E=mc2, if the object is moving at the speed of light (or faster) it can only exist as energy, therefore making our subatomic particles into tiny conglomerates of energy (Capra, 2013, p. 75).

If subatomic particles are energy, how do we make matter out of this energy? To answer this question, we need to familiarize ourselves with one more concept in quantum physics called the *observer effect*. Particles exist as possibilities expressed by wave function unless they are observed. The wave a particle possesses is not a mechanistic wave of vibrational pattern in space and time, but it is an energy wave, which exists as probability outside of space and time. When observer starts looking for a particle like electron for instance, the act of observation (directing energy) causes a collapse of electron into matter. Only then it becomes local in space and time. When observer is no longer observing, electron turns back into energy wave and again becomes nonlocal possibility (Goswami, 2008, p. 537).

To summarize this, we can say that objects are energy *in potentia* till observer collapses it into matter (Goswami, 2008, p. 541). Who is the observer then? Contemporary physicists have their differences of opinion on the subject and many formed their own theories. Out of all of them, the most plausible and logical is Dr. Amit Goswami's theory of consciousness. In his theory, Dr. Goswami took a quantum leap from the universe based on matter to the universe based in consciousness. He boldly stated that quantum physics requires consciousness for its interpretation (Goswami, 2008, p. 761). He convincingly showed us that in order to remove all paradoxes in quantum mechanics including the observer effect we need to assume that consciousness, not matter, is fundamental and primary reality (Miller, 1993). Everything is

made of consciousness; it is the ground of all being. What are some attributes of this consciousness, which is also called quantum field? It has ability to create. It chooses with a purpose. It has intentionality. One might say that the theory of primacy of consciousness is leaving the realm of science and is entering the realm of metaphysics, and I say, it is about time! For further insights and scientific discourse on understanding what consciousness is I recommend Dr. Goswami's book - "God is not dead".

The discovery of quantum world showed us reality entirely different from Newtonian materialism. Quantum reality turned out to be indeterministic. Objects were waves of possibilities and could be at several places at the same time. Interactions between objects were non-local in addition to local. Non-local interactions were instantaneous, did not travel thru space-time and were signal-less. In addition to continuous movements, discontinuous or quantum leaps were allowed. This quantum aspect of our reality appears to be on the other spectrum of gross-subtle polarity of universe.

Universe is governed by Newtonian and quantum laws of physics and although they appear to be contradictory, they are actually complementary. Why do physical laws exist? The answer to this question belongs to the realm of metaphysics. All we can say with certainty is, that these laws exist independently from us. We can observe them, discover them, but we cannot change them. Scientific theories provide temporary explanation to the mystery of nature, until better ones are discovered. Let us for now treasure the unity of mechanistic and quantum laws and use this knowledge for the betterment of humanity.

Chapter 3: Evolution of Medicine

The same principle of understanding nature and relation of humans with nature, which permeated physics, shaped the art of healing. Throughout the history of medicine, we can identify similar three periods which mimicked previously described three periods in physics. These periods in medicine are: Hippocratic medicine, Newtonian medicine and quantum medicine.

Aristotle in his eloquent and logical understanding of physics clearly presented to us concept of unity between human and nature. He supported the ancient Greek belief that everything in nature - both, animate and inanimate was made out of four elements: earth, water, earth and fire. Aristotle's compatriot and almost his contemporary, Hippocrates - a great physician, used the same four elements as a basis for understanding of diseases and medicine in general. The idea that earth, water, air, and fire made up all matter remained the cornerstone of philosophy, science, and medicine for two thousand years.

Interestingly the four elements do align with the four states of matter that modern science has agreed on: *solid* (earth), *liquid* (water), *gas* (air), and *plasma* (fire).

No-harm Holism of Hippocratic Medicine

Hippocrates, who was born in 460BC is known to us as a father of medicine. His philosophy of cure was one of healthy mind and healthy body. He had a holistic understanding of the human organism. Hippocrates used the four elements (earth, water, wind and fire) to describe the four "humors" found in the body - blood, phlegm, yellow bile and black bile. These visible secretions were his only window into understanding how the body worked. He stated that the temperaments (emotions) and humors needed to be in balance with each other in order for a person to be well, both mentally and physically. He understood intuitively that emotions and health are one. Disease resulted from humors disharmony and imbalance (Kleisaris, 2014). The physician's job was to restore health by correcting the imbalance and restoring harmony to the humors. To quote Hippocrates:

> The body of man has in itself blood, phlegm, yellow bile, and black bile; these make up the nature of the body, and through these he feels pain or enjoys health. Now, he enjoys the most perfect health when these elements are duly proportioned to one another in respect to compounding, power and bulk, and when they are perfectly mingled. Pain is felt when one of these elements is in defect or excess, or is isolated in the body without being compounded with all the others (Humorism).

In therapeutics, Hippocrates saw the physician as the servant and facilitator of nature. All medical treatment was aimed at improving the natural resistance of the organism to overcome the

disease. For this, he prescribed diet, gymnastics, exercise, massage, hydrotherapy and sea bathing (Editors, 2016).

He had a great influence on modern healthcare by establishing the solid clinical model of medicine. It included detailed history taking, meticulous observation, complete physical examination followed by assessment and treatment according to available evidence-based knowledge. His model is still widely accepted and practiced in contemporary medicine (Kleisaris, 2014).

Hippocrates was the example of the perfect physician - educated, caring and compassionate. His famous Hippocratic Oath set high ethical standards for the practice of medicine. His way of life and way of practicing the art of healing has been a source of inspiration for many generations of doctors and healers.

Deterministic Reductionism of Conventional Medicine

Once organismic view of the world started to be replaced by mechanistic view, natural holistic medicine rooted in unity of body and spirit also abandoned the wholeness. The emotions and health were no longer one. New era of mechanistic medicine began.

The seventeen century Scientific Revolution of classical physics had enormous impact on the way medicine was understood and practiced. This was an era of studying human anatomy and physiology. Dissecting human bodies for the sake of knowing how the body was built became a common practice. The sixteen century anatomists noticed that frequently diseases

were indeed accompanied by changes in anatomy. They formed a conclusion that illness can only be created by abnormalities in anatomy and that by studying the parts we can know the whole. The prevailing Hippocratic doctrine of the balance of the four humors began to crumble under visible and seemingly undisputable proof of anatomy (Sternberg, 2001, p. 10).

Invisible forces like thoughts and emotions were not taken into consideration. The Cartesian dichotomy of body and mind and his explanation of human being in purely mechanical manner were dogmatically incorporated into medicine instead (Chopra, 2015).

Significant impact on the shape of mechanistic medicine had Darwin's theory of evolution. His theory was based on randomness with no room for purpose. The end result of his doctrine was a reigning belief of present society in separation and competition as the way of life. This is contrary to fundamental rule of nature which is unity and cooperation (Braden, 2017, p. 216).

The final product of modern medicine is based on Newtonian physics. It became embedded with two principles: materialism and reductionism. Materialism states that there is physical explanation for every phenomenon. Reductionism posits that complex problems can be broken into smaller components to find a solution (Chopra, 2015).

This model of medicine is based on upward causation. It believes that human body is made out of matter only, and everything that happens inside the body can be traced down to material interactions. Life simply can be reduced to the movement of molecules which obey deterministic physical and chemical laws. Atoms and molecules make cells. Some of the cells

becomes neurons and make brain. Brain then becomes responsible for all our subjective experiences and its epiphenomenon is consciousness (Goswami, 2004, p. 10).

The widely accepted concept of upward causation is expressed as genetic determinism and it is a premise for molecular biology. Since phenotype is the expression of genotype, genes (genotype) are said to be responsible for all biological structures and functions (phenotype) (Goswami, 2008, pp. 232-235).

Curing the symptoms occurs on physical level. Invisible forces such as thoughts and emotions are inconsequential. In this model of medicine, physician sees himself as a mechanic. He sees the disease as something physically broken in the human body and he seeks to find the broken part believing he can heal by replacing broken part with the new one. He relies on technology and finds intuition and personal touch redundant.

Conventional medicine keeps improving tremendously its diagnostic abilities, treatment modalities and care delivery. Its progress, although clearly visible, remains restricted to the laws of classical physics.

Integrative Healing of Quantum Medicine

Quantum physics showed us the existence of the atomic world - invisible, but nevertheless real. Its revolutionary view into behavior of matter proved that materialistic medicine is inadequate in explaining the process of healing.

The human body, along with everything else in this universe, is made of atoms, which are 99.999…% energy and 0.000…1 % matter, therefore human bodies cannot be viewed as physical matter only. Since atoms are governed by principles of quantum physics, it only makes sense that these principles have to be incorporated in a way the medicine is practiced.

In present day reality, conventional model of modern medicine, ingrained in upward causation is still stubbornly looking for faulty matter. It still believes that molecular biology holds the key to the elusive secret of health and healing, in spite of quantum physics showing us that human bodies do not end at the level of molecules but melt into a field of consciousness. The human bodies are the physical manifestations of this consciousness. In consciousness we first exist as a wave of possibility, and consciousness (an intelligent observer) collapses us into physical reality (Goswami, 2008, p. 428). This primacy of consciousness, resulting in downward causation is a backbone of the quantum model of medicine.

With incorporation of quantum physics into medicine came realization that human beings are not separate entities, they are quantum entities, impossible to separate themselves from each other. The body then, cannot be viewed in isolation. This realization allowed us to incorporate quantum thinking into every aspect of healing (Chopra, 2015).

Principles of quantum physics such as non-locality, tangled hierarchy and quantum leap, which are the new ways of healing, are being successfully incorporated into this new paradigm of medicine. In this model, medicine is integrative and multidimensional. It includes three compartments: physical body medicine, vital body medicine and mind body medicine. Healing

therefore takes place on physical and non physical levels. Newtonian linearity used in physical body medicine, plays a small part only. There is no more mind-matter dichotomy and no reductionism. There is primacy of consciousness over matter, therefore causation is downward.

Chapter 4: Quantum Concepts of Integrative Medicine

Incorporation of quantum physics into the integrative model of medicine created a need for revision of fundamental concepts such as disease, health and healing. In addition, this new description of expanded human anatomy and physiology, which now includes subtle energy, had to be created. Lastly, a new understanding of integrative physician and integrative patient became necessary to move forward with this new model of healing.

Integrative Anatomy and Physiology

The purpose of having a human body is to have the ability to know and interact with reality. As quantum physics revealed to us, reality is gross and subtle, matter and energy, particle and wave. In classical, materialistic anatomy, we only learned about physical body, because we believed that gross reality was the *only* reality. We could define this reality of matter with our five senses. But in subtle reality there is a non-physical world of wave and possibility and we are perfectly capable of experiencing it with our non-material body.

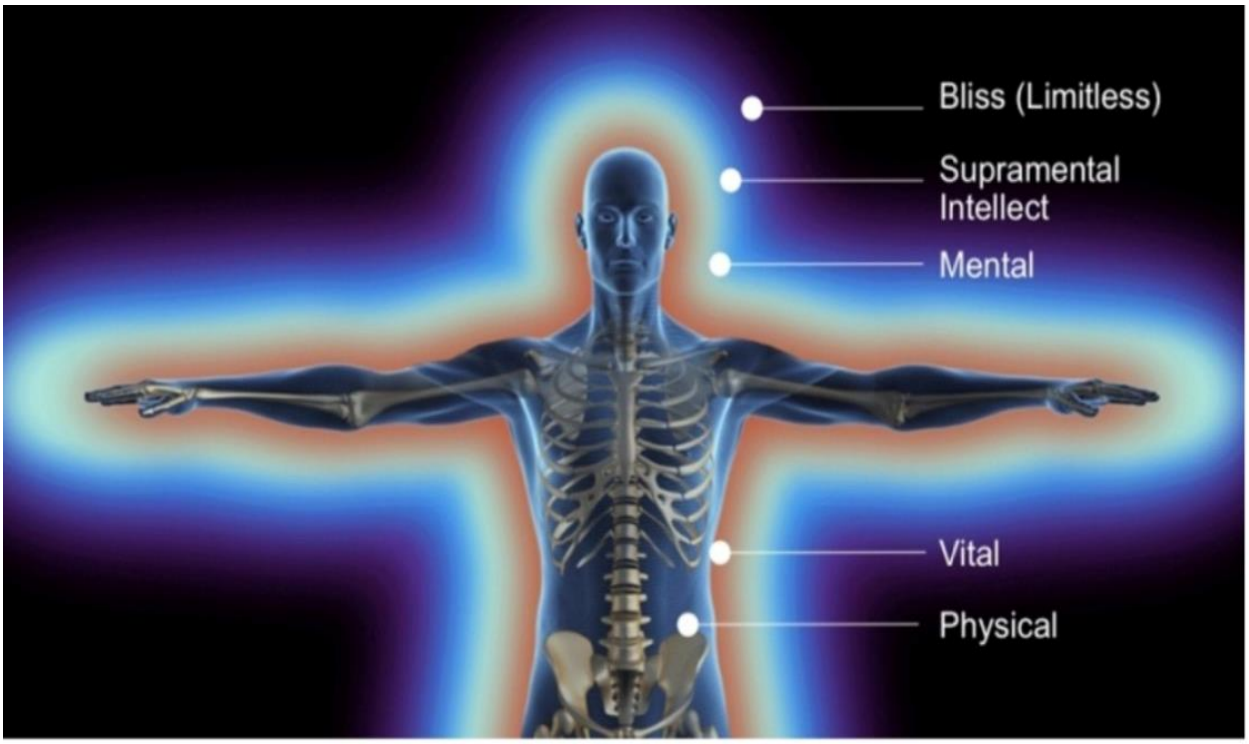

Figure 4.1: Anatomy of quantum body. Source: IQUIM

Figure 4.1 represents a conventional model of quantum body. This innovative model identifies five distinctive bodies in the human body which are: physical, vital, mental, supramental and bliss body. Only the physical body resides in this space-time reality, the other four reside non-locally, outside of space-time reality. This means that our bodies are four-dimensional and we are timeless beings.

Each of these five bodies allows one to experience life in four different ways: through sensing, feeling, thinking and intuiting. All our bodies have quantum qualities, which means that

they exist *in potentia* until consciousness collapses them, through the downward causation, into actuality (Goswami, 2012, p. 166).

Subtle bodies are functional not structural, but they do permeate our physical body. They are part of that 99.99999…% energy that makes us. They are all in us and outside of us at the same time. The difference between them is in their energetic frequency, with vital body having the lowest frequency and bliss body representing the highest. Each frequency corresponds to the level of information, which means that bliss body encompasses the highest level of information.

Physical body.

This is the domain of matter. We experience the physical reality with our physical body thanks to our five senses: sight, hearing, touch, smell and taste. Our physical world is the only one experienced as external. The worlds of vital, mental, supramental and bliss are experienced as internal. The physical body is needed to make representations of non-physical world.

Physical world has macro-physical structure made from micro-physical. It has microscale-macroscale division. Macro-physical loses most of its quantum potency and is predominantly Newtonian but as with all objects it is a possibility. For the macro objects, waves of possibility are very sluggish but nevertheless their movements can be verified with laser instruments. This sluggishness of physical matter is perceived by our senses as illusion of separateness (Goswami, 2012, p. 136).

Reaction between physical and non-physical is not dualistic. It is mediated by consciousness. When consciousness collapses a material wave of possibility, we manifest the experience of sensing. When we sense, we are choosing from the potentiality of the physical and collapsing material objects in space and time (Drouin).

Consciousness simultaneously collapses the wave of possibility of physical and its vital body, making the physical body a representation of the vital body blueprint (Goswami, 2004, p. 32).

Having physical body is very useful, since it allows us to share our experiences with others.

Vital body.

This is the domain of life force. Vital body guides biological form by holding the blueprints of the entire physical body and its biological functions (Goswami, 2004, p. 31).

We cannot easily explain how biological form is made, what guides the cells differentiation in embryo to make a complex human body out of a single cell. This process, known as morphogenesis, therefore cannot be explained by molecular structure of DNA only. In 1981, English biologist Rupert Sheldrake showed that biology needs non-physical entities to explain how the form is made. He proposed the concept of non-physical morphogenetic fields that influence the cells. Those fields are regions of activity acting as blueprints necessary for

creation of the human body with all its biological functions. Consciousness uses these blueprints to make physical representations of its vital functions. It simultaneously collapses the possibility wave of vital body and physical body to make organ representation. This process creates occurrence of two parallel correlated experiences. One is the experience of physical world which we sense/perceive. The other one is experience of the world of morphogenetic fields, which we can feel. These two worlds do not interact directly, instead they are parallel to each other and consciousness non-locally maintains their parallelism (Goswami, 2008, p. 992).

Morphogenetic field is a base of quantum physiology. It explains how the organs are all connected because their morphogenetic fields are energy, therefore not demarcated.

We are born with our own morphogenetic fields from our ancestors. They are not genetically inherited though, but rather inherited through the process of morphic resonance which is a fundamental memory in nature (Sheldrake). At the same time, our personal beliefs have ability to reshape our blueprint and our vital body becomes individualized as a result of conditioning.

The existence of this domain of vital body which held the secret to vitality and ability of organism to regenerate, was intuitively known to ancient healers. Thanks to discovery of morphogenetic fields, the Chinese medicine (acupuncture - chi energy), Ayurveda Medicine (chakras - prana energy), homeopathy (disease as a breakdown of vital forces) now have scientific base.

Mental body.

Mental body also known as mind, is a home to thoughts and meanings. In spite of prevailing materialistic belief, thoughts are not made in the brain, although to have thoughts the brain is needed. Thoughts are the result of collapsing the possibility wave of mind. They are processed by giving them meaning or interpretation. We choose the specific meaning for our thoughts from the meaning possibilities of mind. This process gives us the experience of thinking (Goswami, 2004, p. 28). Thoughts are internal and cannot be shared directly. Mind gives meaning not only to our thoughts, but also to experiences taking place in our vital and physical body - feeling and sensing. When the meaning is assigned to a particular movement of vital energy, we call it an emotion. When meaning is assigned to physical sensations it becomes a memory stored at the cellular level of the body.

Mind can also make the mental representations of supramental archetypes (Goswami, 2012, p. 130). For instance mental representation of archetype of moral law is conscience. The activity of mental body can be indirectly reflected by brain waves (EEG).

Every individual mental body is defined by its unique mental habit pattern, because every person processes the meanings differently. We can use our mind to process thoughts, feelings and sensations as fundamental creativity (quantum leap), situational creativity (new meanings created from old contexts) and conditioning (using known mental meanings) (Goswami, 2004, p. 187). Our mental habits are the results of this processing. This is extremely important to understand since mental habits are directly tied to our health. Mind, by utilizing the power of

placebo and intentions is capable of creating coherence between our beliefs and reality which manifest itself as health.

Supramental body.

This is the place where manifestation, or creation started through the process of involution. Involution which is the imposition of limitations, was needed for consciousness to start evolution. These limitations are observed as universal laws of physics and biology, being some of the examples. Supramental body is therefore a reservoir of laws and rules which allows the universe to exist. It holds archetype of all experiences of the world (Goswami, 2012, p. 166).

Supramental body holds ultimate design for each individual and makes each of us unique. It holds our soul, the inner moral law, conscience and altruistic, unselfish behavior (Goswami, 2012, p. 178). It also holds the key to the design of our morphogenetic fields which is why healing can only take place at the level of supramental body.

We experience the collapse in our supramental body - a movement of supramental energy, as a special type of thoughts. They are called intuition or insights. They are special, because meanings to intuition are based on archetypes and are always positive. Intuition is the most universal and natural ability every human possesses. It is a gift, which is not learned but inherited, although the ability to access it varies from person to person. In the process of intuiting, subconscious mind is used but conscious thoughts are bypassed. (McCraty, 2015, p. 50). How can unconscious intuition react with conscious thought process without duality?

Consciousness as the ground of all being makes it possible. Recent studies have shown that intuitive information is received by heart first and then heart relays it to the brain **(**Childre Doc, 2005**)**.

Supramental body is not represented in physical body yet. We can only make mental representations of supramental. Doctor Goswami believes that physical representation of supramental body is our next evolutionary step (Goswami, 2008, p. 4185).

Because we have supramental body we can love unconditionally, be kind and empathetic. We can see beauty in everything, make every living moment joyful and discover the true nature of the self.

Bliss body.

This is the realm of consciousness and spiritual wholeness. All the possibilities are unlimited. Everything in here is *in potentia*, there is no manifestation. For human being, this is a body of transcendence. A state of complete dissolution where there is no distinction between mind and body (Drouin).

This is the place of transcendental experiences of mystics. This is the place of miracles. When Jesus changed water into wine, he transcended the supramental laws of physics. He was able to do so by having access to bliss body (Goswami, 2012, p. 268).

In summary, we need to look at the human body from the vantage point of psychophysical parallelism. Consciousness contains four compartments of possibilities - supramental, mental, vital and physical. With quantum collapse, the possibilities manifest as the material body, vital body, the mind and supramental intellect.

Integrative Concept of Disease

A search through any medical dictionary proves that a satisfactory definition of disease is surprisingly difficult.

A phrase: *Any abnormal condition of the body or part of it, arising from any cause* (Medical Dictionary for the Health Professions and Nursing**)** is commonly used to define a disease. I personally find this definition too broad to be helpful. The quantum based integrative medicine, on the other hand, describes disease as an absence of ease, which is a more useful definition.

Disease has a quantum nature and one can observe the complementarity of it - a particle and a wave aspect. Wave is the source of disease and carries the answer to the question why the disease happened. Particle, which is a collapsed wave, answers the question of what happened, based on physical manifestations of a disease (Goswami).

In allopathic medicine, the origin of disease is always in the physical body. Not so, in integrative medicine. Quantum anatomy expanded the model of human body to five

interconnected but individual bodies, and a disease can originate in any one of them. Disease therefore, in this new model, can be classified as material body disease, vital body disease, mental body disease, supramental body disease and the whole-body disease, depending where the root cause of a disease is. Most diseases occur in more than one of five bodies (Drouin).

The physical level of disease is a result of a problem with body physics or chemistry. The classical causal examples of these are: physical trauma, bacterial and viral infections and genetic defects. The vital level disease is a result of a problem with morphogenetic fields - our body blueprints. Negative emotions by creating energy imbalance in morphogenetic fields are capable of producing this disease. The mental level disease is a result of assigning wrong meanings to our senses, feelings or thoughts. Wrong mental meaning creates disharmony between the vital and physical body. The supramental level disease is created when supramental context is not correct. The whole-body disease happens when we lose wholeness.

In reality there is no such entity as disease on the physical level only. Almost every disease, apart from symptoms on the physical level, comes with a degree of feeling of illness at the vital level. This frequently is associated with wrong meanings at the mental level and a sense of separateness from the supramental and bliss levels (Goswami, 2004, p. 49).

This integrative concept of disease is clearly more useful than traditional allopathic model, especially for medical doctors. It touches upon a very important issue of the role the mind plays in keeping us disease-free. Additionally, it highlights the obvious but worrisome fact that mental stress is a huge contributing factor to the majority of today's illnesses.

Integrative Concept of Health and Healing

The definition of health given by The World Health Organization (WHO) is quite holistic. It states that health is *"a state of complete physical, mental and social well-being, not merely the absence of disease or infirmity"* (Constitution). Integrative medicine upholds the same viewpoint, that health is not an absence of disease only.

Health is a state of greater personal integration in which all five bodies are in harmony with themselves and consciousness (Drouin, 2014, p. 51). Personal growth, increased awareness and better understanding of our relation with the universe are associated with health. In health, full potentiality is achieved and happiness is found. This state of so-called positive health is a potentia. It is a wave of possibility, until brought into manifestation by consciousness. We have potentiality of being perfectly healthy.

To achieve positive health the care has to be given not only to the physical body but to vital, mental, supramental and bliss body as well. The physical body is taken care of with proper nutrition, maintenance of physical fitness and routine medical checkups. Eating fresh food which contains more vital energy is good for vital body and so is the special type of yoga (hatha), and special type of breathing (pranayama). The mental body is taken care of by practicing concentration. This can be done during the concentration meditation or by simply mentally repeating a mantra. Alternating concentration meditation with mental relaxation is beneficial for the health of supramental body and improves the chance of quantum leaps to the

supramental. The simplest way of keeping the bliss body healthy is adequate amount of sleep, although having an ability to sleep with creativity in mind is the superior way of exercising bliss body (Goswami, pp. 250-252).

Integrative healing is a much deeper reality than healing solely based on materialistic science. Healing, similar to a disease, has a particle and a wave aspect. Particle is subject to a local healing which is allopathic, and wave encompasses a non-local quantum healing.

Physical body is targeted for healing via local allopathic medicine. Acuteness and severity of damage to the physical body has to be addressed first, because without physical body there is no representation of vital, mental or supramental bodies. When physical body is in distress due to trauma, overwhelming infection, organ failure or other medical emergency, allopathic approach has to be used immediately to save it. This type of healing happens through upward causation. It has ability to repair the physical body but it cannot heal the whole body simply because energy, not matter, holds the key to healing (Goswami, 2004).

In non-emergent situations, non-local healing which targets all subtle bodies, using quantum creativity should be carried out. Physical body, as the only visible body, should remain a reference point in order to assess the health state of subtle bodies. Non-local healing which is a gentle micro-healing, can be classified as vital body healing, mental body healing and supramental body healing. Its final goal is achievement of balance in all bodies, which translates into improved vitality.

Vital and mental body healing, similarly to physical body healing, can only contain the disease. Complete healing requires discontinuity or quantum leap, which can only happen at the level of supramental body. Integrative healing strives towards achievement of wholeness. Consciousness, being a holder of all potentialities for existence takes part in all aspects of healing.

These new concepts made it necessary to revolutionize, update, expand, rethink, and redesign the role of physician in the process of understanding disease and health. This is a task for the integrative physician.

Integrative Physician

All healers, whether practicing allopathic, alternative or integrative medicine must know the answer to the question I asked myself in chapter 1: Why did I become a doctor? In my own case, the main driving force in achieving this goal was a desire to heal. This realization requires the follow-up question: Why do I have a desire to heal? Not everybody has this particular desire, so it must be a vocation. The word vocation comes from Latin word *vocatio*, meaning "a call". Historically, vocatio meant divine call to God's service or a function in life to which one is called by God (Vocation, 2020). This formulated my personal belief of becoming a doctor as my answer to God's calling me to a life of serving those in need of healing.

An integrative physician will absolutely have no problem with this concept because he is well aware of the fact that healing comes from the higher power. This power is defined as

consciousness in quantum physics and as God in metaphysics. Consciousness is the ground of all being and source of all healing. In order to even grasp the glimpse of this truth, consciousness needs to be first personally experienced by a physician. The awareness of being connected to this consciousness is the initial step in becoming an integrative physician. Mindfulness, prayer and meditation are excellent practices to deepen a personal relation with God/consciousness.

The integrative physician recognizes the *complementarity* of energy and matter and uses this knowledge to his advantage. He implements the laws of quantum physics such as non-locality, tangled hierarchy and discontinuity into his scope of practice.

What is the role of an integrative physician in the process of healing? After all, I just stated that all healing comes from consciousness. This concept can be well grasped by implementing the quantum concept of *tangled hierarchy*. In a nutshell, consciousness responds to correlated desires of the patient seeking health, and his physician seeking to heal, by choosing health from the infinite field of possibility. The desire to heal is not a wish list; it requires skills and engagement on behalf of the doctor and the patient. Consciousness seldom just grants the gift of healing, and much rather desires to form a triune connection with a healer and a healee. When the three become united by the same desire, infinite possibilities of healing, including spontaneous healings are attainable.

The principle of *non-locality* in quantum physics states that it is possible to communicate without a signal and have effect at distance. This principle, supported by multiple experiments, added scientific validity to the healing power of prayer (Goswami, 2004, p. 57).

Non-locality also adds validity to the power of intention. Intention is an activity of a mind related to action. It is a thought, therefore it carries non-local quantum energy, with an amazing ability to change the physiology or more precisely the molecular structure of the object of our intention. Intention indeed can affect the future and is the major source to healing. The power of intention gives us humans, the freedom to choose among endless quantum possibilities to become healing actuality, if we so desire. O*pto, ego sum*. The outcome of healing is influenced by the quality of intent. Intention must always be geared towards the greater good (McTaggart, p. 17).

The principle of discontinuity validated medical miracles or spontaneous healings. Similarly to the electron appearing and disappearing from its orbit without being detected in the intermediary position, so can a gravely ill person fully recover almost immediately from the illness, without going through the intermediary process of healing. In spite of thousands of well documented instances of spontaneous healings, the medical field maintains the attitude of *"this is not possible"* rather than, *"I did not know this is possible"*. The deeply rooted notion of perceiving the acts of saving lives as the mere result of medical technology, leaves no desire among medical professionals to study spontaneous healings (Rankin).

Quantum anatomy of the human body, based on matter and energy makes the concept of spontaneous healing not only understandable but in fact credible, therefore applicable in real time. In case of mind disease, when imposition of disturbed emotions, wrong thoughts and belief systems creates a disease, the correction of these wrong meanings has the potential to remove the disease. This requires a *discontinuity* – a quantum leap to the supramental to change the meaning. The integrative physician, by exercising his powers of creativity and intuition, needs to open the possibility for quantum leap and make the correct meaning manifest to the patient.

Integrative Patient

The most challenging task for the integrative physician is the integration of his patients. The difficulty arises from the fact that the overwhelming majority of patients is conditioned towards two expectations. First, patients do not want to take responsibility for their personal health, and expect the doctor to make them better. Second, patients do not want to invest time in the process of healing, and expect healing to be a quick fix.

Being familiar with this prevailing view on health and healing, the integrative physician realizes how radically each patient needs to be re-educated. To start with, the physician needs to make sure that the patient understands that health is the matter of his choice. Once he knows that they are unlimited possibilities to choose from, he can choose between health and disease. This freedom to choose is not wishful thinking. Consciousness is a crucial part of this choice, so the patient needs to know what consciousness is, and how it heals. Although the power to heal

belongs to consciousness, the patient needs to be an active seeker of health. He needs to work towards it rather than just wait for it to happen.

The integrative patient needs to be familiar with the concept of self-healing. He needs to know that self-healing is also a choice, and can be manifested once the patient develops the ability to align his personal awareness with cosmic awareness.

All this might sound somewhat esoteric on paper, but in practice it is quite straightforward. The key element is the degree of physician's personal integration. The more integrated the physician is, the more integrated the patient can become. Why so, one may ask? Quantum reality showed us the uniqueness of doctor - patient relation. They can communicate *locally* - through the energy field, and *non-locally* - through quantum entanglement. The energetic communication between human beings, also known as cardio-electromagnetic communication, is the result of the magnetic field produced by the heart. The signals transmitted through the heart's electromagnetic field can be picked up by other people's nervous system. When this type of communication is applied to therapeutic interactions, it has a great potential to promote the healing process. Sensitivity to this form of energetic communication between individuals can be further enhanced by practicing heart coherence by the doctor and the patient (McCraty, 2015, pp. 36-44). The non-local communication between the patient and the doctor can occur through quantum entanglement. The doctor can feel the patient's vital energy through quantum non-locality of the vital body.

Once the patient understands this true paradigm of healing, common concepts such as healthy nutrition, healthy life style, and healthy emotions are not dubious activities for him, but the pillars of whole health.

Integrative Medicine for Primary Care

It is no secret that contemporary medicine, as advanced as it is, has serious limitations. It seems to be overlooking the fact that in spite of ever-increasing financial resources devoted to medical care, it fails to increase quality and years of healthy life. The incidence of various chronic diseases is growing rapidly with no real cure being available. Medications in those cases, can offer a temporary symptomatic relief at best or create iatrogenic disease at worst.

Certainly, a better healthcare is needed to remedy this worrisome situation. For starters, the medical community needs to stop pretending that the laws of quantum physics are not relevant to understanding of human body, and understanding of healing processes. Quantum physics revealed to us that physical reality, in its very essence, is obeying the law of complementarity. Every atom is a wave and a particle. The same complementarity is the foundation of the healing process, therefore, it needs to be reflected in the structure of integrative medicine. Matter medicine needs to complement energy medicine. Presently, the energy medicine, belongs to complementary and alternative medicine (CAM) category and represents any healing modality aiming at improvement of vital energy or vitality. There is a

common belief that energy medicine is a pseudo-science, in spite of many clinical trials demonstrating its validity (Goswami, 2004, p. 54). Acupuncture, homeopathy, the Chinese medicine, Ayurveda, spontaneous healings, prayer healing, and heeling at distance, have all demonstrated the power to heal in multiple clinical trials. A small step towards integration of CAM with allopathic medicine was already taken. For the most part, its use is restricted to pain management in end-stage cancer patients, and only after all allopathic modalities of treatment have been already exhausted. Only in this state of professional defeat on one side, and compassion for patient's suffering on the other, allopathic physician is willing to believe in a healing power of complementary medicine, including healing prayer. Knowing that we are capable of this heightened state of compassion, why not apply it to every patient?

How can we practically integrate matter and energy medicine in a way that would benefit the patient most?

First, we should make this new paradigm of healing taught in colleges of natural medicine and medical universities (Drouin). Why not teach the prospective physicians and energy healers that they are two sides of the same coin? The present state of our population's health suggests that it is time to end this ongoing competition between allopathic and alternative healers. To end the futile finger-pointing for the sake of better medical outcomes. Let us examine the basic healing philosophies of both sides. Allopathic practitioner is trained to look at the patient in terms of finding a disease, implying that disease is an invader hiding somewhere inside the body, and needs to be found and eradicated. The patient is an innocent bystander, a victim of this invasion. Alternative medicine practitioner looks

at the patient in terms of finding an imbalance, implying that *milieu intérieur* needs to be assessed and restored to its full functionality. Patient is a fully aware and fully empowered participant in this process. In other words, one healer monitors disease and the other monitors health. Is one better that the other? The law of complementarity tells us that both ways are equally important because they both complement each other. Energy medicine cannot remain an optional modality, used only as the last resort.

This brings me to a second aspect of practical integration. The health insurance companies need to acknowledge the validity of alternative medicine and integrate its services into insurance plans. This will create equality and a freedom to use and choose both modalities by a practitioner.

The third aspect of integration deals with a question: Who is to decide which modality of treatment to use? I believe this is a job for primary care physician, because allopathic modality should always be used first, for the reason I explained in my chapter on "Integrative Concept of Healing". Should every primary care physician become proficient in CAM? With the complexity of practicing allopathic medicine this will not be feasible on a common scale. Nevertheless, basic navigational skills of the healing principles in CAM should be familiar to a primary care physician. Some of them, like healing prayer, requires no special skills, therefore can be used freely and abundantly. Should the patient require more in-depth evaluation and correction of multilevel imbalances and deficiencies, an educated decision about referring the patient for a specific complementary treatment should be made. Presently, such referrals seldom happen. It is the patient, who on his own, seeks alternative type of

treatment, either due to lack of results from medical treatment or distrust in allopathic medicine. This is unfortunate, because the patient is not the best equipped to make this type of decision.

Fourth practical aspect of integration would include an implementation of naturopathic model of looking at population health status and tying it to a clinical decision-making process. In this model, patients are divided into three categories. About 5% of population feels unwell and has one or more illnesses. These patients belong to a *sick* category. About 20%, feels well and have no identifiable disease, they are part of *healthy* category. The remaining 75% of population falls in the category of *functional* (Drouin). The categories of *sick* and the *healthy* patients are pretty obvious, but a category of *functional* patient needs additional explanation. Any medical practitioner, especially in primary care, can easily relate to a patient who comes for a visit with vague symptoms such as fatigue, generalized aches and pains, insomnia, vague abdominal complaints, among others. After initial history taking, physical examination and some additional, clinically appropriate diagnostic tests, no disease is found to account for patient's symptoms. Two scenarios would follow at this point. Either the patient is sent away with the instructions to come back if his symptoms worsen, or more commonly, the patient is being subjected to exhaustive and expensive further diagnostic testing. This endless quest to "rule out" the presence of every possible hypothetical disease, does nothing to alleviate the patient's feeling of unwellness. All it does, is bankruptcy of the healthcare system.

Let us try to approach the *functional* patient from the vantage point of integrative medicine. This patient has no physical disease that we know of, therefore the only allopathic

treatment possibly offered would aim at alleviation of symptoms. On the contrary, CAM healer would know right away that any state of subjective unwellness, without the evidence of disease, indicates presence of energetical imbalances. These are caused by specific stressors present either in the physical body or in one of the subtle bodies. This patient suffers from low vitality and would benefit from incorporating vital medicine or mind-body medicine into his management.

This approach is the tool needed to move the *functional* patient into 20% *healthy* category bracket instead of waiting for him to progress into 5% *sick* category. The quality of lives for so many patients would improve tremendously and huge amounts of money in healthcare would be saved at the same time. This is medicine at its best.

Being an allopathic primary care physician, studying integrative medicine, I would often ask myself a question: Do I have to give up being a medical doctor to practice integrative medicine? Then I realized that neither I, nor my patients are above the laws of quantum physics. I am a complementarity - the two sides of one coin, and this chapter is my personal vision of taking care of my patients from now on. My patients are complementarities as well; they are a wave and a particle, and I intend to treat their both states to the best of my ability.

Chapter 5: Stress and Disease

The word “stress” is one of the most commonly used words globally today. Although we might have trouble actually defining what stress is, we all know what it feels like to have stress in our life. The term stress in physiologic and psychologic sense was originally used by Walter Bradford Cannon (1871-1945) - an influential American physiologist who in his paper reporting psycho-endocrine studies used such phrases as times of stress and great emotional stress. Cannon also invented the word homeostasis, coined the phrase fight-or-flight and proposed the existence and functional unity between sympathetic system and adrenal gland (Goldstein, 2009).

The popularization of the term *stress* however began with work of Hans Selye (1907-1982) - Hungarian-born endocrinologist, who by conducting his innovative research in the domain of stress earned himself a title of the Father of Stress. Stress defined by Hans Selye, was defined as non-specific response to any pressure or demand. For Selye it was understood as total response of the organism - mind and body (Juarez-Reyes). Selye’s concept of stress can be narrowed down to two ideas. First, body responds to all stressors in similar way, which he called the general adaptation syndrome, but which we now call the stress-response. Second, if stressors go on for too long, they can make you sick.

This concept that prolonged stress can produce physical disease as well as mental disorders is now widely accepted (Goldstein, 2009).

What is this stress that we talk about on daily basis? In general, a person experiences stress when a demand exceeds a person's coping abilities (McCance Kathryn, 2010, p. 337). To understand this concept better, we need to understand Dr. Walter Bradford's meaning of homeostasis. Homeostasis is a state when all our physiological functions such as oxygen level, temperature, and pH of internal fluids are kept at optimal levels. Anything that throws homeostasis out of balance causes stress, and factors causing this situation are called stressors. Stressors could be physical, like bacterial infection, body injury, ingestion of toxins, or it could be psychological, like taking an exam, speaking in public, or confronting a difficult co-worker. Regardless of the stressor, body turns on the same stress-response as stated by Dr. Hans Selye.

There is a specific and very important type of psychological stress stemming from our ability to worry about things that might happen to us. These "worrisome" thoughts, which are mostly undesirable, can easily turn on stress response just by anticipation of disruption of our homeostasis. This type of stress response is called anticipatory response (McCance Kathryn, 2010, p. 339).

Stress is not a situation or event per se, but our emotional response to the situation or event. It is our perception of reality which we define as stressful or not. In spite of stress being a totally subjective phenomenon, clinical research was able to pinpoint what stress is all about. It is a perception of having no control over the situation (Doc Childre, 2005).

Is stress all bad? Not at all. The effects of stress exist on a bell curve. Some of it is good, but too much becomes bad.

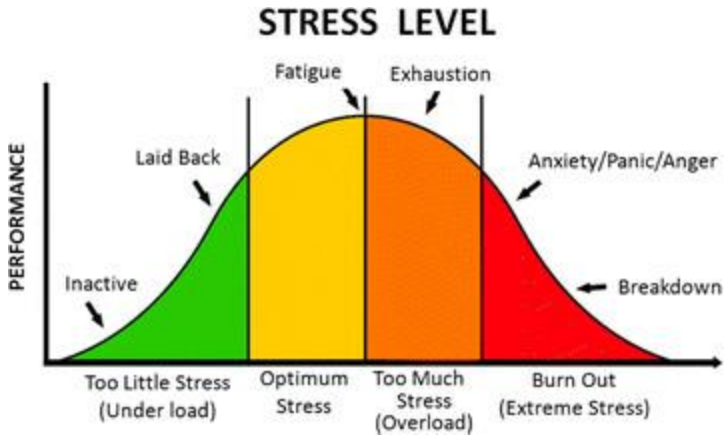

Figure 5.1 Stress level and performance. Source: ttps://www.researchgate.net

As depicted above in Figure 5.1, secretion of stress hormones by the nervous system increases performance but only to a certain point. After that point, continuous flow of stress hormones decreases performance. At this point, not only stress hormones are no longer beneficial but become harmful to health. What distinguishes *good stress* from *bad stress* is timing.

Let us first examine the body response to short acting stress. Initial body response to stress involves activation of the sympathetic branch of autonomic nervous system (ANS) which causes release of stress neuropeptides - epinephrine and norepinephrine. Epinephrine is secreted as a result of the actions of the sympathetic nerve endings in the adrenal glands, norepinephrine is secreted by all the other sympathetic nerve endings throughout the body. The sympathetic arousal triggers the whole cascade of widespread bodily reactions known as fight-or-flight response. Neuropeptides make their way to the blood very quickly and as soon as stressful

situation is resolved they are being deactivated within minutes, so no real harm to the body is done.

In prolonged continuous stress, hypothalamus-pituitary-adrenal (HPA) axis is activated. Hypothalamus, which is a control and integration center for ANS, decides if a signal is stressful. If it is, hypothalamus releases corticotrophin release hormone (CRH) which stimulates pituitary gland to release adrenocorticotropic hormone (ACTH). ACTH stimulates adrenals to release cortisol. Without an opportunity for the body to recover, constantly circulating in the blood cortisol starts having an effect on immune system, because immune cells have receptors for stress hormones. Cortisol shuts down immune cells' responses, shifting them to a muted form, less able to react to foreign triggers. As a result, if a person is exposed to a bacteria or virus, an immune system is less able to react and this person becomes more susceptible to that infection. This influence of stress on immune system is what makes stress bad (Sternberg, 2001).

Diverting energy from various long-term building projects in order to solve short-term stressful emergencies is another negative effect of stress.

Stress shortens human life by shortening telomeres. Telomeres are regions at the ends of a chromosome that prevents DNA helix from unwinding or accidental fusion of two chromosomes together during cell division. Once body loses telomeres it starts making defective DNA. Telomeres of chromosomes in most cells shorten with age. Telomere length is maintained by the enzyme telomerase. Resilience to stress, and positive emotions such as gratitude, happiness,

love and self-respect stimulate the synthesis of telomerase, which subsequently delays aging and age-related diseases (Lipton). Stress can also shorten human life by changing gene expressions.

Out of three types of stress - physical, chemical and emotional, emotional stress is by far the worse. Negative emotions such as anger, frustration, hopelessness and lack of control is what we feel when we experience stress (McCraty, 2015).

The majority of diseases such as cardiovascular diseases, diabetes mellitus, ulcers of digestive system and irritable bowel syndrome proved to have a very strong component of emotional stress. The discovery of this causal relation between emotions and physical health sparked significant scientific research in the field of emotional stress. Not only do we understand the negative effects of emotional stress better but we also learned how to eliminate emotional stress from our lives.

Chapter 6: Emotional Stress

Pre-modern medicine recognized the link between disease and emotion for millennia and understood intuitively that health and emotions are one. Ancient Greek, Roman, and Indian Ayurvedic physicians, all enlisted the theory of the four humors (blood, yellow bile, black bile, and phlegm) in their healing practices, believing that imbalances in these four visible bodily secretions caused disease. They also believed that humors' imbalances were often caused by the emotions.

This link between emotions and physical body was unfortunately dissolved in the era of modern science by Rene Descartes and others, who considered emotions as subjective and unpredictable, therefore non-significant and non-scientific. Only what could be proven beyond doubt with the tools or rationalism was the source of truth. Descartes' *res cogitans* or pure mental activity remained a separate entity from physical body, which created difficult to reconcile mind-body duality (Rooney, 2019).

In the present day, emotions are again linked to the physical body. Their positive and negative effects are well recognized and emotional stress is presently a subject of many intensive studies. For the most part, the materialistic concept of relation between emotions and brain prevails. The majority of scientists bound by the classical physics' law of conservation of energy, force themselves into belief of upward causation, to avoid the problem of dualism between mind and matter. They hold the belief that emotions are the results of action potentials in the specific neurons followed by biochemical molecular changes. In other words, emotions are epiphenomena of the brain.

Much better way of understanding the causal relation between emotions and brain is the model of downward causation and primacy of consciousness, explainable by the laws of quantum physics. This logical and comprehensive model was intuitively recognized and practiced for thousands of years by the Chinese medicine (TCM) and Ayurveda healers.

Emotions and Stress in the Chinese Medicine

The Chinese medicine (TCM) began in China over 5,000 years ago. It came about as a result of countless lifetimes of experience, insight, and experimentation. TCM is quite systematic and a complete medical system using the perceived laws of nature as rules for understanding disharmony and disease. The oldest known book about Chinese medicine is The Yellow Emperor's Inner Classic. It was compiled before 200 BC. It is a summary of medical ideas and techniques that were in use long before the second century BC.

TCM is about *chi* energy, which is another name for vital energy. *Chi* has two complementary components: yin and yang, and it is made of matter and the energy force, that moves matter. Yang is a wave aspect and is expressed as creativity and change. Yin is a particle aspect, representing conditioning and stability. This duality of *chi* is similar to duality of light energy which is known to quantum physics as *complementarity phenomenon* (Oleson, 2014, p. 46).

The balance of yin and yang in *chi* guaranteed good health, and TCM looked at disease as imbalance of vital energy movement. This non-local energy in reality represents multiple layers of information making up our morphogenetic body. It is conventionally flowing in distinctive bundles of energy called meridians. TCM recognizes twelve main meridians; six of them are yin and the other six are yang. Ten out of the twelve meridians correspond to the five yin organs (lung, heart, liver, spleen and kidney) and five yang organs (stomach, small intestine, large intestine, urinary bladder, gall bladder) (Oleson, 2014, pp. 52-58). Each meridian is a yin-yang

pair, meaning each yin organ is paired with a corresponding yang organ. Chinese healers used the knowledge of movement of *chi* through meridians and the relation between meridians, physical organs, and vital energy to heal by using the technique of acupuncture. Acupuncture points were understood to be gateways between morphogenetic fields and their corresponding physical bodies (Drouin, 2010). Accessing the right meridian through the right acupuncture point was known to correct an imbalance between yin and yang, and restore the flow of *chi*. This subsequently led to improvement of the disease or temporary healing. No complete healing can be achieved at the level of morphogenetic fields.

The most important point in understanding the usefulness of TCM is the realization that the vital energy can be rebalanced not only with acupuncture needle but with the mind also. The flow of *chi* can be easily influenced by thoughts and emotions. Positive thoughts and emotions cause harmonious and abundant movement of *chi* through all meridians. Negative emotions, and thoughts with wrong meanings, cause energy imbalance in meridians, which negatively affect the morphogenetic field and subsequently creates disease (Drouin, 2014, p. 53).

The use of vital energy medicine is no longer the privilege of the acupuncturists only. This energy can be used effectively by other energy healers, and by everyone in the process of self-healing. Self-healing requires an awareness of our quantum body and its complementarity. The energy aspect (yang wave) is our quantum-self, and the physical aspect (yin particle) is our ego-self. It is our creative quantum-self which has the power to choose and to change; choose positive emotions, choose right meanings for our thoughts and behavior patterns, and choose health over disease.

Emotions and Stress in Ayurveda

According to modern Ayurvedic sources, Ayurveda has been traced to around 6,000 BC when it originated as an oral tradition. Ayurveda is one of the few systems of medicine developed in ancient times that is still widely practiced in modern times. Like the Chinese medicine (TCM), Ayurveda is a vital body medicine. Although Ayurveda developed independently from TCM, there are striking similarities between these two schools of healing, which adds tremendous credibility to their combined knowledge.

Ayurvedic practitioners recognized and acknowledged the presence and importance of vital energy in the human body, which they called *prana.* They were well aware that imbalances of *prana* resulted in the lack of health. They also knew that emotions played a crucial role in the amount of prana available in the different areas of vital body. Positive emotions created large amounts of vital energy, while negative emotions created very little of it.

Figure 6.1: The chakras. Source: Website

Figure 6.1 represents conventional location of the seven energy centers, known as *chakras* in Ayurvedic medicine. They are pictured as located along the spine, with first chakra being at the bottom of the spine and the last one at the top part of the head.

The *chakras* represent the movement of vital energy, or more precisely: *"Chakras are those points in the physical body where consciousness simultaneously collapses the movement of important morphogenetic fields along with the organs of our body that represent these morphogenetic fields"* (Goswami, 2008, p. 3108). We experience this collapse in different parts of physical body as feelings (Goswami, 2004, p. 44).

All individual *chakras* are believed to be in relation with specific internal organs, either energetically (via dedicated autonomic plexuses), or biochemically (via corresponding endocrine glands). The amount and frequency of energy in each *chakra* is responsible for creation of different chakra-specific feelings (Dispenza, 2017, p. 95).

Root chakra - It is placed in the proximity of large intestine, kidneys and urinary bladder. Its vital body function is elimination. The endocrine gland associated with root chakra is the adrenal gland. Neurologically, it is associated with the superior mesenteric plexus. The negative emotions of fear and insecurity prevent the vital energy collapse in this chakra, which leads to medical problems in the lower digestive tract, kidneys and urinary bladder. To make vital energy available to root chakra, positive emotions of forgiveness, letting go, and feeling safe need to be generated.

Sex chakra - It is located below navel and governs ovaries, uterus, testes and the prostate. Its vital body function is reproduction. Estrogen and progesterone in women, and testosterone in men are hormones correlated with this center. It is connected neurologically to the inferior mesenteric plexus. Negative emotions of unfulfilled lust keep this chakra depleted, while balanced, healthy sexuality, and true self-respect keep the vital energy flowing freely.

Navel chakra - This energy center governs stomach, small intestine, liver, gall bladder, spleen, and pancreas. Vital body function is maintenance. Liver, stomach and pancreatic enzymes are associated with navel chakra. This chakra is under neurological influence of the solar plexus. Energy flow is absent here whenever we experience anger, frustration, lack of confidence and unworthiness. The flow is restored by the emotion of self-worthiness.

Heart chakra - This energy center governs the heart, lungs and thymus gland. The vital body function is distinction between me and not me. The hormones associated with this center are growth hormone and oxytocin. Heart chakra is neurologically associated with the cardiac plexus. Negative emotions blocking heart chakra are envy, jealousy and possessiveness. Romance, compassion and universal love keep vital energy flowing freely through heart chakra.

Throat chakra - It governs throat, speech organs and thyroid. The vital function is self-expression. Endocrine glands are thyroid and parathyroid. It is associated with the thyroid plexus. The energy flow here is abundant whenever we create the ability to express ourselves clearly and freely. Every time we experience frustration in expressing ourselves verbally, the flow to this chakra decreases.

Brow chakra - It is represented in the midbrain and hindbrain. Its vital function is evolution. It is associated with the pineal plexus and hormones of pineal gland. Transformation from the negative state of confusion to clarity and intuitive understanding keeps this chakra balanced.

Crown chakra - It is represented in neocortex. The vital function is self-knowledge. It is associated with the pituitary plexus and pituitary gland. Feelings of despair and dissatisfaction with life prevent the creation of vital energy in this *chakra*. Once we are able to achieve the positive state of permanent happiness and purposefulness in our life, the energy flow is restored (Goswami, 2004, pp. 145-146).

The concept of chakras demonstrates how clearly, although intuitively, Ayurveda understood the unity of mind and body. The Ayurvedic healers understood that sickness did not have to start in the body but more frequently it started in the mind. They also understood that negative emotions were the source of imbalances and subsequently diseases in the body.

Now, we have a scientific model for the concept of chakras. We know that interaction between non-local mind and local brain is indeed possible and it is mediated by consciousness. We know that chakras get activated by the energy of our thoughts and feelings. The mind gives meaning to our thoughts and feelings, and the meaning we choose will affect the chakras either in a positive or negative way. The thoughts with meaning guide the activation of the autonomic nervous system (ANS), and the feelings with meaning (emotions) activate multiple endocrine glands. That is how the mind controls the vital and physical bodies. Chakras, by pairing the

state of mind with body symptoms are our inner “checkpoints”. We all should learn how to interpret their language and use it as self-applied mind-body medicine.

Modern Theory of Emotions and Stress

Since the establishment of a clear connection between emotions and health, or more accurately, between emotional stress and disease, human emotions became the object of many intensive studies. The two distinctive activities of the brain - thinking and feeling, or what is called today intellect and emotion, have long been recognized**.** Traditionally, the intellect was considered rational, therefore dominant, and emotions were viewed as irrational, therefore submissive. This theory of vertical relation between thinking and feeling has been replaced with the entirely new, horizontally connected model of equal partners. In this model, intellect and emotions are mediated by bi-directional connectedness between cortical, limbic, and brain stem components. These connections make it possible for emotions to influence our cognitive abilities such as decision making, judgement, memory and learning. At the same time, the cortical brain blends emotions with knowledge gained from previous experiences, and allows us to deal with emotions rationally. What is peculiar about thinking and emotional brain connection is the discovery that the number of neural connections going from the emotional brain to the thinking brain is much greater than the number going the other way. This neuronal favoritism towards afferent flow from limbic subcortical structures towards prefrontal cortex in some way

explains the powerful influence of emotions on thought processing. It also explains while it is so difficult to turn off strong emotions by thought alone.

Since emotions underlie the majority of the stress we experience, development of emotional intelligence is essential for successful navigation of life.

Brain and emotions.

The human brain is the intelligent information manager. It receives the information from the body and responds to it by adjusting physiological functions, in order to keep the body at its optimal level of functioning. While subconscious brain uses homeostasis to autoregulate, the conscious brain uses smart homeostasis called allostasis. Allostasis is the ability of the brain to predict what the body will need for optimal performance (Barret, 2019).

Emotions are internal functional states and contribute significantly to optimal body functioning. They have two separate components: a perception of feeling and the response. The brain monitors feeling and then responds with physiological and behavioral action. The brain can be taught to develop the ability to elicit emotional response to the feeling that is the most desired. This ability is called emotional *intelligence* (Blackett, 2014).

The source of the information in emotion making, comes in the form of sensory input. It can originate either from external or internal sensory systems of our physical body. Both systems are processed differently.

Our internal stimuli come from internal responses which are visceral, i.e. related to inner organs. This inner physical state is monitored by the autonomic nervous system (ANS). ANS is always active and processes visceral responses subconsciously. ANS presents us though, with a simple feeling of the internal state. If everything is in working order, we feel well, but if any problems are detected by ANS, it will signal us to feel bad. In the case of major problems, ANS will send more defined signals to the prefrontal cortex such as pain or nausea.

The external stimuli which are experiences of the world, are perceived with five senses. These stimuli such as touch, sound, taste, smell or an image, activate sensory receptors. The information from sensory receptors travels via specific neuronal pathways and carries this information to the limbic system. The limbic system tags the information as either safe or dangerous, meaningful or unimportant. From there, information is further processed by temporal, parietal, and occipital lobes of the cortex, where the information is compared to past experiences. After that, it reaches the prefrontal cortex for final perception, interpretation, and physiological response. Because the perceived external stimulus could be interpreted in many ways, the brain needs to be activated in many ways also, to match the interpretation. Different meanings are represented in the brain as different action potentials. The difference is in the time intervals between action potentials. This language of frequencies is actually the primary method of communication in physiological systems (McCraty, 2015, p. 36).

Along with activation of prefrontal cortex, mind activates hypothalamus, which serves as an interface between brain and body. Hypothalamus, based on the quality of a thought, activates energetically selective parts of autonomic nervous system (ANS). In addition, the hypothalamus

hormonally activates the pituitary gland, which will further activate or inhibit corresponding endocrine glands. The hypothalamus, along with pituitary and other endocrine glands, releases hormones and other peptides, called molecules of emotions. Their effect is a physiological body response in specific organs.

Making of emotions on the level of matter is very complex. It involves numerous hard wired neuronal connections, biochemical bridges, receptors, neuropeptides and languages of patterns. The whole brain together with the input from the body, is needed to create the experience of emotion (McCraty).

This is a reductionist model of understanding emotions. It helps us to identify some fragments of the emotion making process, and indeed we can find relations that appear linear. It might appear that activated neurons release neurotransmitters and hormones, which are released into the blood and delivered to all the cells. If indeed these are cause and effect relations, what activated the neurons first? Did a thought occur first and triggered the perception, or did perception occur first and the brain interpreted it? One cannot tell. There is no beginning or end, no linearity. Consciousness is needed to really understand what emotions are.

In consciousness-based model, the emotions are perceived as the whole human phenomena and its experience encompasses the activity of body and mind. Physical, vital and mental bodies are all involved in making emotions. Each emotion consists of physical effect, movement of vital energy, and mental thought (Goswami, 2004, p. 142).

Feelings occur in physical body as physical sensations and in the vital body as movements of vital energy. To be more precise, the physical body sensations are gross representations of subtle movements of vital energy. Mind gives meaning to both of these feelings and by doing this, gives us the experience of emotions.

We can clearly see that the mind is the key element in emotions and the emotions are the products of mind-body entanglement. Mind moves the vital energy, and at the same time interprets its movement. The subtle movements of vital energy collapse physical component of emotions. These give us physical perception of reality, which again is interpreted by mind. Consciousness mediates all interactions involved in experience of emotions.

In conclusion, we can choose to become emotionally intelligent rather than being victims of our emotions. Emotions do not happen to us, we create them. They are our best guides to experiencing reality and the best guides to maintaining optimal health.

Heart and emotions.

Heart and the rest of the cardiovascular system are the first ones to become functional in embryo. The heart starts to beat on the 23rd day of conception, when the baby human barely measures 2.2 mm. This happens long before the nervous system is formed. To this day there is no credible explanation to the question what triggers the first beating myocardial cell.

In many ancient cultures thoughts and emotions were associated with internal organs. For instance, in Mesopotamia, 4,000 years ago, the heart was considered to be the center for intellect, while liver housed thoughts and feelings. Similarly, Egyptians revered heart as the seat of wisdom and home of mind. The famous "weighing of the heart" depicts the story how after death, two gods, Thoth and Anubis weigh the heart of the deceased to determine the person's worthiness. Even Aristotle considered the heart the command center of the body, responsible for movement, sensations, and all psychological activity (Rooney, 2019, pp. 13-14). Heart was therefore regarded as a source of wisdom, spiritual insights, thoughts and emotions.

The Chinese medicine, like other ancient cultures, gave heart a superior role. Heart was considered the ruler of all organs, and the heart meridian was called Absolute Master. All other organs would give off their energy to support the energy of the heart. Heart was the organ, which controlled the emotions. It was also the dwelling place of *Shen* - the spirit. In other words, the heart, not the brain was responsible for our mental and spiritual activity. Heart belongs to the element of Fire and it is the fire energy that makes heart a dominant organ. Fire is the source of positive healing and connects us to universal love, in order to feel energy in all five elements. It is associated with season of Summer. Heart is a giver of capacity to love. Love is the blossoming of human being. It is in the full bloom of love that we achieve our fullest potential (Drouin, 2010).

The heart in Ayurveda is under the influence of energy center known as heart chakra. In the heart we experience feelings such as warmth, lightness, tingling, and expansion, which are attributes of love energy (Goswami, 2004, pp. 143-144). The ability to feel and understand

genuine love maintains healthy flow of vital energy through the heart chakra. If the feeling of love is suppressed or misinterpreted, vital energy cannot reach this chakra. Low vital energy affects proper functioning of thymus gland which is located in the heart proximity. Thymus gland is part of the immune system whose role is to distinguish between "me" and "not me". Lack of this distinction is the basis for autoimmune disease and malignancy, therefore mis-perception of love could be a contributing factor to a development of immune related diseases. Vital component of our conscience is in the heart, and people with more sensitivity to vital energy are more conscientious (Goswami, 2012, p. 180). Open heart chakra allows us to experience better vitality in our lower chakras and higher awareness in our higher chakras.

Present knowledge of the heart's role in humans goes far beyond viewing it as a mechanical pump only. Heart is now seen as an endocrine gland also, since it secretes several hormones and neurotransmitters. It is a source of strong electromagnetic field as well, detected in every part of the body. All these functions are attributed to physical heart. Heart additionally has a subtle energetic component as well. This energetic heart is non-local, and in terms of its frequency spans over vital, mental and supramental bodies. This explains heart's central role in influencing emotions, thoughts, and intuition (McCraty, 2015, p. 55).

The heart is able to be a key component of emotional system thanks to its interactions with brain and the rest of physical body. For instance, one experiences the feeling or sensation of love as heartache in the physical area of the heart. The heart responds to emotions, plays a major part in determining the quality of our emotional experience, and has the ability to create emotional stability.

Multidynamics of heart-brain connections.

The HeartMath Institute Research Center, since the early 1990's, studied extensively physiology of heart to brain communication. This communication is a dynamic two-way dialogue. Both organs continuously influence each other function. Out of all systems, the heart and the rest of cardiovascular system delivers the largest amount of information to the brain.

The physical heart communicates with the brain in four major ways:

- neurologically - through the transmission of nerve impulses,
- biochemically - via hormones and neurotransmitters,
- biophysically - through pressure waves,
- energetically - through electromagnetic field (McCraty, 2015, p. 7).

Neurological communication - In 1991 a team of scientists from University of Montreal discovered presence of about 40,000 interconnected neurons, which formed its own communication network within the heart (Braden, 2014). In other words, heart has its own mini-brain, which is called *the intrinsic cardiac nervous system*. This unique circuitry allows the heart to learn, remember, feel, sense, and even make decisions (McCraty, 2015).

The communication between the heart and the brain occurs via sympathetic and parasympathetic branch of the ANS. The flow of information is bi-directional; from heart to brain via *afferent* nerves and from brain to heart via *efferent* nerves.

Descending activity from neocortex, limbic brain and medulla, travels via efferent fibers of both branches of ANS: sympathetic - via spinal cord and parasympathetic - via vagal nerve. This neuronal activity becomes integrated into the intrinsic cardiac system, or the “mini-brain”.

The intrinsic cardiac nervous system additionally receives input from sensory neurons such as baroreceptors and chemoreceptors. Baroreceptors are stretch-sensitive mechanoreceptors located in the chambers of the heart, carotid sinuses and the aortic arch. They serve as detectors of change in blood pressure, heart rate, and heart rhythm. Chemoreceptors detect changes in level of hormones and other molecules in the blood. Once information from efferent pathways of ANS and sensory neurons has been processed by the heart's intrinsic nervous system, it is relayed back to the limbic system and neocortex via afferent pathways in the spinal column and vagus nerve (McCraty, 2015, p. 6).

Biochemical communication - The heart communicates with the brain and body biochemically; via hormones it produces. The heart was reclassified as part of the hormonal system in 1983, when a new hormone produced and secreted by the atria of the heart was discovered. This hormone called atrial natriuretic peptide (ANP), is released from myocardial cells in the atria and in some cases the ventricles in response to volume expansion and possibly increased wall stress (Colucci Wilson, 2019).

The heart contains cells that synthesize and release catecholamines: norepinephrine, epinephrine and dopamine, which were once thought to be produced only by neurons in the brain and ganglia.

It also manufactures and secretes oxytocin, commonly referred to as the love or social bonding hormone. Beyond its well-known functions in childbirth and lactation, oxytocin also has been shown to be involved in cognition, tolerance, trust, and friendship. Remarkably, concentrations of oxytocin produced in the heart are in the same range as those produced in the brain (McCraty, 2015).

Biophysical communication - It occurs through pulse wave. When the heart contracts, it causes systolic increase in the blood pressure and ejects blood in rhythmic, pulsatile manner, in the form of a pulse wave. The quality of this pulse wave is critical for normal brain function. Pulse wave has two characteristics: shape and rhythmicity. Rhythmicity of pulse wave depends on heart rate variability (HRV). Optimal HRV assures good quality pulse waves and subsequently good cerebral flow (Mark E. Wagshul, 2011). Heart also communicates with the brain biophysically via mentioned earlier baroreceptors, which respond to the stretch. These receptors are located in the heart wall and blood vessels and constantly monitor the changes in the blood pressure. Rising blood pressure stretches the wall of the heart and activates baroreceptors, which via afferent vagus nerve fibers instruct the ANS to slow the heart rate, which causes drop in the blood pressure (Schwartz Mark, 2016, p. 384).

Energetic communication - It occurs via electromagnetic field interactions. The heart is the source of the body's most powerful electromagnetic field. Electrical component of the heart's field permeates every single cell in the body and is about 60 times stronger than electric field of the brain. The magnetic component of the heart's field can be detected about 3 feet away from the body and is approximately 5000 times stronger than the brain's magnetic field. This ever-

present field has a very powerful influence on many processes in the body. It can produce electromagnetic signal strong enough to synchronize the entire body, specifically brain rhythms and respiratory rhythms.

The heart, with each beat, not only pumps blood, but also continually transmits dynamic patterns of neurological, hormonal, mechanical, and electromagnetic information to the brain and throughout the body. (McCraty, 2015, p. 93)

The above presented analysis, which describes multiple ways of communications between heart and brain, clearly paints the picture of the heart as the dominant player in body physiological and mental states. Afferent input from the heart significantly affects perception and behavior and can affect brain activity either in positive or negative way. It appears that the Chinese medicine practitioners were right in their belief that the heart was the key component of the emotional system.

Heart coherence and heart rate variability.

The HeartMath Institute, for the last 25 years, geared its scientific research towards the psychophysiology of stress, emotions, and interactions between the heart and the brain. Its scientific findings demonstrated the profound effect of emotions on the heart's magnetic field. Through this field, the heart sends the information about the emotional states to every cell of the body. Each cell is capable of translating environmental signals into behavior with the help of its

membrane. Some of membrane receptor proteins extend like the antennae from the cell's outer surface and have the ability to read vibrational energy fields (Lipton, 2015, p. 199).

The Institute researchers further discovered that emotions are actually interconnected with rhythmic patterns of the heart (Thurber Myron, 2017, p. 23). These rhythmic beating patterns change significantly, depending on the emotion being experienced. For instance, positive emotions, such as love or appreciation, are associated with a smooth, ordered, coherent pattern in the heart's rhythmic activity. Generating sustained positive emotions can achieve a state of psychophysiological coherence, which is a state of optimal function in both emotional and physiological processes. It is a result of synchronization between the activity of the heart, brain, and other bodily systems like blood pressure and respiration (Rollin & Zayas, 2014).

Figure 6.2: Coherent heart rhythm pattern. Source: Borowski&Borowski, MDs

Figure 6.2 depicts a screenshot of how the coherent heart rhythm pattern looks like. This smooth sine-wave-like pattern is the result of sustained positive emotional state.

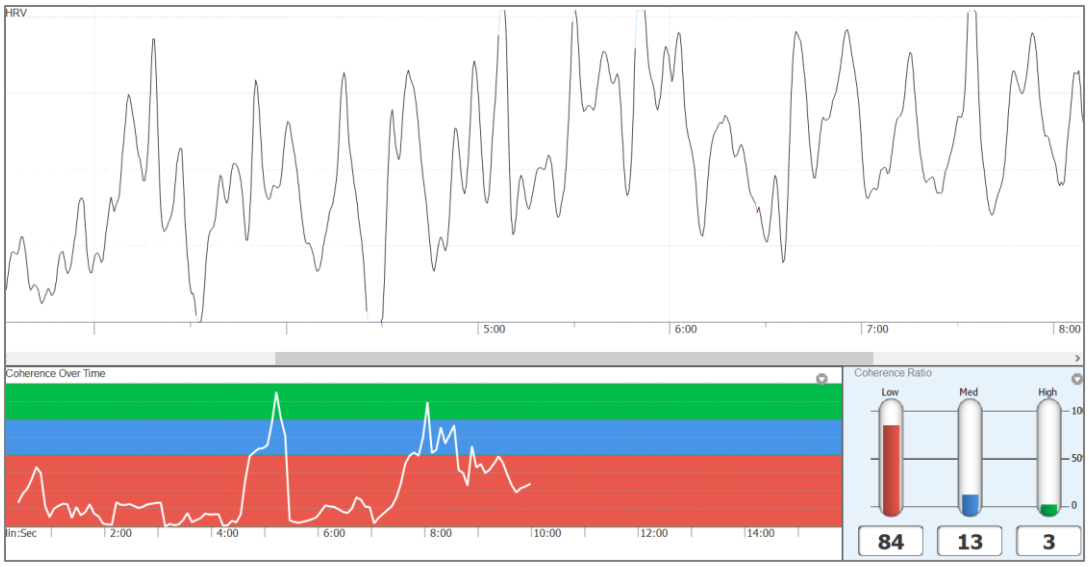

Figure 6.3: Incoherent heart rhythm pattern. Source: Borowski&Borowski, MDs

Figure 6.3 shows incoherent heart rhythm pattern. This erratic and disordered pattern is the result of negative emotions such as, anger or frustration.

Heart rhythm is a result of constantly changing time interval occurring between consecutive heartbeats. The cardiovascular system like most biological systems, due to ongoing various homeostatic processes, shows constant variation. This naturally occurring beat to beat variation is called heart rate variability (HRV). Measurement of the HRV can be done by recording the interbeat interval between R spikes on ECG, or from interbeat intervals measured from pulses in the ear or finger, using pulse plethysmograph (Schwartz Mark, 2016, p. 91).

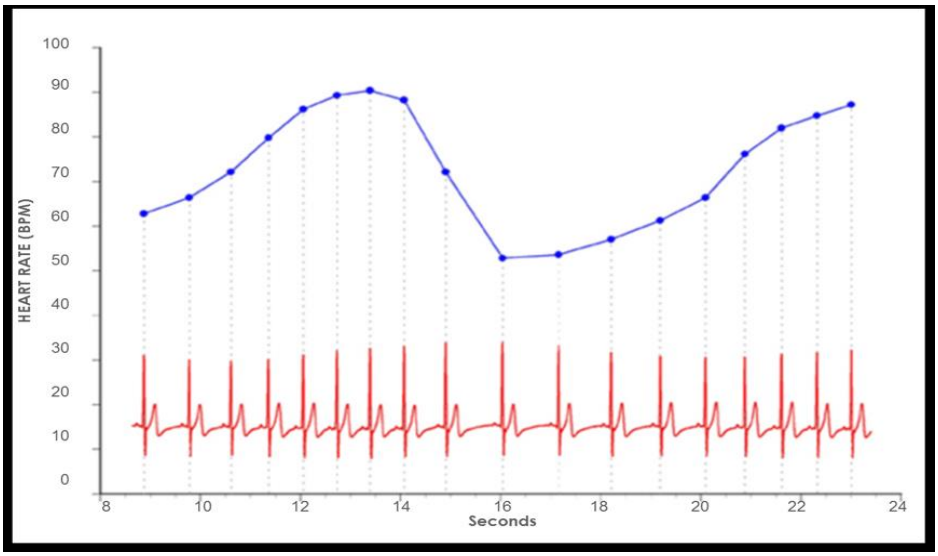

Figure 6.4. Heart rate variability (HRV). Source: HeartMath Institute

Figure 6.4 represents heart rate variability (blue line) and single lead electrocardiogram (red tracing). HRV is a measure of the normally occurring beat-to-beat changes in heart rate and the blue line represents plotted consecutive time intervals between each of the heartbeats. The electrocardiogram (red tracing) shows variations in beat to beat intervals. This pattern of heart-rate accelerations and decelerations is the basis of the heart's rhythms.

The key component to understanding heart rate variability is the balance of ANS. Normal HRV is predominantly created by synergistic action of sympathetic and parasympathetic branches of ANS and to a lesser degree by two other physiological mechanisms: respiratory sinus arrhythmia and baroreceptor reflex.

Sympathetic branch accelerates heart rate and parasympathetic branch slows it down. Any abnormal process connected to the activity of ANS has the potential to affect the various HRV parameters, therefore the analysis of HRV can be used to indirectly assess the plasticity of ANS, and to assess the resilience of heart in adapting to changes in ANS (Schwartz Mark, 2016, p. 201). Term *respiratory sinus arrhythmia*, describes changes in heart rate related to the respiratory cycle. During inspiration, inhibition of vagal nerve causes increases in the heart rate. During expiration, restored vagal outflow slows the heart rate down (Shaffer & Ginsberg, 2017). The *baroreceptor reflex* changes heart rate in response to a change in blood pressure. Rising blood pressure causes fall in heart rate and fall in heart rate elevates blood pressure. In reality, HRV is even more complex, and represents non-linear interplay of multiple feedback loops of autonomic and non-autonomic origin (Goldberger, 2017).

HRV is a powerful biomarker of physical health, emotional resilience, and cognitive performance. Its parameters are steadily declining with age. Levels below normal for age, are predictive of future health problems, premature aging, and premature all-cause mortality. This makes measurement of HRV useful in health risk assessment and psychological assessment of self-regulatory capacity (McCraty, 2015).

HRV can be measured by different methods which are categorized as time domain measures, and frequency domain measures.

Time domain measures such as SDNN and RMSSD are the simplest to calculate, and quantify the amount of HRV during monitoring period. *SDNN* stands for standard deviation of

normal to normal R-wave duration. In short term resting recording, the primary source of variation is parasympathetically mediated. 24-hour SDNN recording is a "gold standard" for cardiac risk stratification (Shaffer & Ginsberg, 2017). *RMSSD* stands for the root mean square of successive differences between normal heart beats. It is used to estimate vagally mediated changes reflected in HRV (reflex vagal tone). Lower RMSSD values correlate with higher incidence of sudden cardiac death.

Frequency domain methods assign bands of frequency and then count the number of inter-beats intervals that match each band. The bands, using Fourier analysis, are divided into three frequency ranges: high frequency (HF) from 0.15 to 0.4 Hz, low frequency (LF) from 0.04 to 0.15 Hz, and the very low frequency (VLF) less than 0.04 Hz. Different frequencies have different driving forces but overall, they quantitatively evaluate influence of ANS on the heart (Thurber Myron, 2017, p. 66).

High-Frequency (HF) Band. This band reflects only parasympathetic or vagal activity and is frequently called the respiratory band because it corresponds to the heart rate variations related to the respiratory cycle known as respiratory sinus arrhythmia. Decreased values of this band are found in heart disease, stress, anxiety, and panic disorder. The magnitude of HF band can be increased by slow, deep breathing.

Low-Frequency (LF) Band. The latest research demonstrates that this band is also affected by the activity of parasympathetic fibers. It is called baroreceptor region which reflects short-term blood pressure control mechanism between heart and brain.

Very-Low-Frequency (VLF)Band. This frequency band is generated by heart's intrinsic cardiac nervous system. It has the strong association with all-cause mortality, PTSD and lethal cardiac arrhythmias.

The other distinctive use of HRV is in biofeedback training. Biofeedback is a mind-body learning tool. It is a two-fold process. First, the measurement of physiological changes like heart rate and breathing, that accompanies subjective experiences such as thoughts and feelings is performed. Second, the measured information is fed back, via computer, in real time, either visually or by using a sound. The goal of HRV biofeedback training is a development of ability to gain control or achieve improvement in physiological state, through optimization of heart-brain connection (Blackett, 2014). In HRV biofeedback, what we are training is heart rate coherence. It is a particular pattern of heart rate variation, which is depicted on Figure 6.2 in this chapter.

The key to generating coherent heart comes from quality of breathing and the quality of emotions. Knowing that certain type of breathing and certain types of emotions can induce the state of coherence, we can consciously learn to breathe better and to feel better.

Breathing patterns modulate the heart rhythms, so it is possible to generate coherent heart rhythm by breathing slowly and regularly. Each person has specific frequency of breath that maximizes heart coherence. This is called *resonant frequency*. As a general rule, the optimal breathing frequency for the best coherence is about 6 breaths per minute (Lehrer Paul, 2014).

The state of heart rate coherence although occurs spontaneously, it is rarely sustained. While slow rhythmic breathing may induce coherence for brief periods, the research at HeartMath Institute demonstrated that self-generated positive emotions are the ones endowed with the ability to induce prolonged periods of physiological coherence. It is quite feasible that feelings we are experiencing as positive, are in reality the reflection of physiological coherence and indeed emotions can be used as bodily clues. When we feel positive emotions, body is in optimal physiological state, and when negative emotions dominate, body is in chaotic physiological state.

When heart functions in coherent mode, it pulls other bodily systems into frequency synchronization with its rhythm, leading to entrainment of these systems**.** Heart has this ability to entrain the whole body because it is the generator of the largest electromagnetic field. In this mode, the body's systems function in harmony and with a high degree of efficiency which subsequently facilitates occurrence of natural regenerative processes (McCraty)**.**

HRV is a powerful mind-body tool at our disposal, and we all should learn how to use it. The more heart coherence we can create, the easier it becomes to change our emotional state at will. By harnessing our emotions, we have a choice how to feel, think, or act. Once we become conscious of our choices, we are free to choose the ones that support our growth, the ones that are more loving, more empowering, and more creative.

Chapter 7: Oxidative Stress

Oxidative stress is an imbalance between cellular production of reactive oxygen species (ROS) also known as free radicals and the counteracting antioxidant mechanisms. ROS are byproducts of the process of energy production.

The major source of energy in aerobic organisms is oxidative phosphorylation, which takes place in mitochondria. It is known by its biochemical name as Krebs cycle. It encompasses the cycle of aerobic respiration, which starts with the inhalation of oxygen necessary to make energy rich ATP, and exhalation of water and carbon dioxide. The process of reducing oxygen to water generates free radicals as by-products. About 98% of inhaled oxygen becomes ATP and about 2 % become free radicals. These proportions are physiological and important to maintaining cellular homeostasis. Free radicals play a beneficial role in defense against infections and in a number of cellular signaling pathways in the process called redox signaling (Salim, 2014).

The main free radicals generated in human bodies are: hydrogen peroxide, superoxide radical and hydroxyl radical. These oxidized atoms and molecules are missing an electron from their external orbit and react quickly with other atoms or molecules in order to gain their electron back. Due to this high tendency to react with other molecules, free radicals can cause large chemical chain reactions inside of the body. These chain reactions are called oxidation and if occurring in excess, cause cellular damage (Phaniendra A, 2014).

The body has the ability to deactivate harmful effects of free radicals using molecules called antioxidants. They are the molecules which can donate one electron to free radicals. This process of gaining electron, called *reduction* by its chemical name, makes free radicals more stable and therefore less cytotoxic (Health Effects of Oxidative Stress).

Oxidative stress is therefore the result of either excessive production of free radicals or decreased number of antioxidants. This imbalance dysregulates cellular redox homeostasis. ROS can act as second messengers regulating redox-sensitive signaling pathways, which elicit very specific cellular responses. Redox signaling is an intrinsic, tightly regulated component of cell metabolism, controlling cell growth, differentiation, and death. The interplay between the production of oxidants and the antioxidant defenses is highly regulated to maintain cellular redox homeostasis, thus its dysregulation underlies many pathological conditions (Franco Maria Clara, 2019).

It is common knowledge today, that oxidative stress is a root cause of many chronic diseases such as diabetes mellitus, cardiovascular and neurodegenerative diseases (Srivastava K, 2015).

Diabetes Mellitus is a disease which results either from defective insulin secretion or insulin resistance and is associated with oxidative stress. The most prevalent type of diabetes mellitus is so called insulin resistant diabetes mellitus (IRDM), which occurs mostly in adulthood. In this type of diabetes, although there is a familiar genetic predisposition (nature), the main precipitating factor is environment (nurture). Environmental factors such as excessive

calorie intake, environmental toxins in air, food, water, and chronic emotional stress, all contribute to development of IRDM. All of these, increase the number of free radicals in the body causing widespread cellular damage. Chronic hyperglycemia, which is a chemical staple of diabetes, further increases free radical production by multiple routes. Oxidative stress therefore, is not only a causal factor in development of diabetes mellitus but the disease per se leads to mitochondrial dysfunction and increased free radical production creating self-perpetuating oxidative stress (Phaniendra A, 2014).

The Central Nervous System is very susceptible to oxidative damage because of its high lipid content, low antioxidant level, and high oxygen consumption. Free radical induced lipid peroxidation and DNA oxidation leads subsequently to many neurodegenerative diseases such as Parkinson's Disease, Alzheimer's Disease, Multiple Sclerosis, and Amyotrophic Lateral Sclerosis (Srivastava K, 2015). There is also a link between oxidative stress and several mental disorders such as depression, anxiety, schizophrenia, and bipolar disorder. This link, along with widely accepted theory that emotional stress is a contributing factor in anxiety, depression and cognitive dysfunction, makes it reasonable to accept the association of emotional stress with higher levels of oxidative damage (Salim, 2014).

Atherosclerosis, a condition known commonly as hardening of arteries, has been associated with oxidative stress as well. The evidence of ROS involvement in endothelial injury has been demonstrated in multiple studies (Phaniendra A, 2014). Detrimental role of oxidative stress in myocardial infarction and heart failure has been documented in number of experimental observations (Givertz Michael, 2015). At the same time, observational studies showed an

association between cardiovascular protection and dietary patterns high in antioxidants from fruit and vegetables, which further strengthens the link between oxidative stress and cardiovascular disease (Tangney Christine, 2017). Additionally, emotional stress has been recognized for the longest time as one of the risk factors for atherosclerosis.

ROS can be produced from either endogenous or exogenous sources. Although exogenous sources of ROS such as air, water pollutions, tobacco smoke, pesticides, heavy metals are known contributors to pathogenesis of the above-mentioned diseases, imbalance of endogenous ROS play a more significant role. The endogenous sources of ROS include cellular organs with high oxygen consumption such as mitochondria, lysosomes and endoplasmic reticulum. And stress is the most common reason for increased endogenous ROS (Srivastava K, 2015).

The exact mechanism of stress induced oxidative damage is very complex and not yet entirely understood. What is known is that during stress, production of ROS increases due to sustained activation of hypothalamus-pituitary-adrenals (HPA) axis which leads to increased respiratory oxygen intake and increased metabolic turnover fueling further oxidative stress (Srivastava K, 2015).

What needs to be underscored is that oxidative stress causes damage on the cellular level and can damage any cell in the body. Red blood cells in particular, due to their constant exposure to free radicals circulating in the plasma, are especially susceptible to oxidative damage**.** The most damaging oxidative path for red blood cells is lipid peroxidation which

results in loss of membrane function (Phaniendra A, 2014). It only takes 15 minutes for the membrane to shrink under oxidative stress (Mohanty, 2014).

Research has shown that relaxation has a profound effect on the expression of genes in red blood cells. Over 2,000 genes changed their expression during relaxation, by demonstrating significant improvement in cellular metabolism, oxidative phosphorylation and generation of reactive oxygen species (Dusek, 2008).

If relaxation reduces oxidative stress in red blood cells, then emotional stress causes just the opposite; it increases oxidative damage to red blood cells.

Chapter 8: Integrative Hematology and Erythrocyte Sedimentation Rate

Hematology is the study of blood and blood-associated diseases. For millennia, the human body was understood as a vessel for a quartet of liquids: yellow bile, black bile, white phlegm, and red blood. Each corresponded to one of the four classical elements - fire, earth, water, and air. From these elements, it was thought, everything in the cosmos was made. According to the second-century physician Galen, blood was made in the liver from food and drink, carried from the digestive tract. This “natural” blood entered the veins and was transported to all parts of the body. Blood was believed to be constantly consumed by tissues and then replenished at each meal. Galen thought that the blood in the left side of the heart came

directly from the right side through pores in the septum, or through leaks from the lungs. The blood in the arteries was "vital"; its purpose was to deliver *spiritus vitalus* to the flesh.

In 1628, Galen's paradigm, of blood produced from food, was dismantled by the publication of "An Anatomical Essay on the Motion of the Heart and Blood in Animals," by the English physician William Harvey (1578-1657). Harvey's revolutionary insight, that blood circulated from the left side of the heart through arteries and returned to the right side through veins, is often cited as the greatest single-handed discovery in medicine (Groopman, 2019).

Blood is made up of a cellular part and a fluid part. *Cellular part* consists of red blood cells, white blood cells and platelets. Red blood cells, which make up about 45% of whole blood, carry oxygen from the lungs to the body's tissue. They also carry carbon dioxide back to the lungs to be exhaled. White blood cells help fight infection. Together with platelets, they make up less than 1% of whole blood. Platelets are small, colorless fragments that stick together and interact with clotting proteins to stop or prevent bleeding.

Plasma is the *fluid part* of the blood. It is a mixture of proteins and inorganic materials, which is about 90% water and 10% dissolved substances. Plasma carries the nutrients to all living cells and ions for proper acid-base balance (Kathryn L. McCance, 2010, p. 952).

Blood analysis is a staple of medical diagnosis. Since blood is in constant contact with every cell, it is a reflection of all physiological processes taking place in the body. The simplest method of blood analysis is observation and this can be done either microscopically or macroscopically. A drop of blood obtained from the pricked finger and placed under the

microscope shows us a world of living blood cells. We observe their size, color, shape, and other attributes in an effort to determine the state of health. We can also observe the blood with our naked eye for the same purpose. This can be done while doing a test known as erythrocyte sedimentation rate (ESR).

Erythrocyte sedimentation rate (ESR) test is very well known to every physician. It was invented in 1897 by the Polish pathologist Edmund Biernacki, and in some parts of the world it is still referred to as Biernacki's reaction. This test measures the distance that erythrocytes have fallen after one hour, in a vertical column of anticoagulated blood, under the influence of gravity (Malcolm L. Brigden, 1999). The test is simple enough to be performed at a doctor's office. Out of two methods of performing the test - Wintrobe and Westergren, the Westergren method is considered superior by International Committee for Standardization in Hematology.

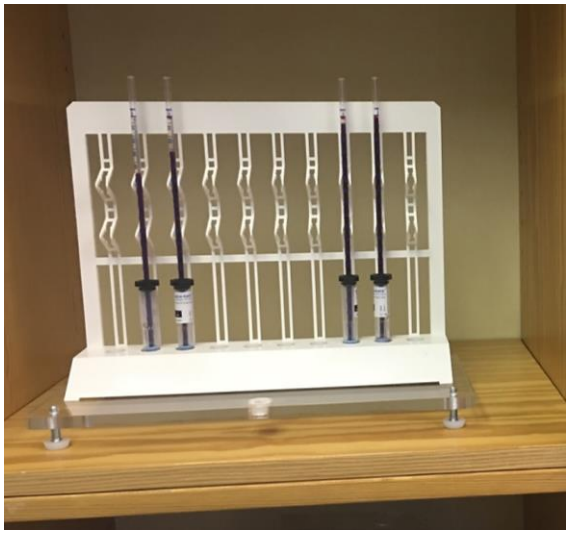

Figure 8.1 –Erythrocyte Sedimentation Rate measurement station. Source: Borowski&Borowski, MDs

Figure 8.1 depicts four Westergren tubes in different stages of ESR measurements. The ESR measurement consists of obtaining a venous blood sample and collecting it in a 2ml tube containing 0.5 ml of sodium citrate. The blood is then transferred into a Westergren tube in the amount needed to fill the tube at the 180 mm mark. The tube is then placed in a rack in perfectly vertical position, and left at room temperature. Once blood is set in the tube, red blood cells start falling to the bottom, separating themselves from the plasma. This line of separation between RBCs and plasma, which is clearly visible, represents ESR measurement point. The point is typically recorded after one hour and expressed as millimeters. The numerical value obtained in this way is called ESR *(Wilson, 1990)*.

The main reason why erythrocytes start falling down in the Westergren tube is the fact that they start aggregating together. The more they aggregate, the faster they fall. ESR in a way assesses the degree of this aggregation. There are two known variables influencing the results of ESR. One is the *properties of plasma* with all its constituents acting as aggregates which is the amount of aggregate, and the other one is the *properties of red blood cells* themselves reflected in the degree of erythrocyte aggregation.

Properties of Plasma

Plasma, being an extracellular fluid, is a part of bio-terrain. The term bio-terrain also known as “milieu interieur”, describes all extracellular body fluids whose main goal is to nourish all cells in the human body. Bio-terrain is a very dynamic system, which needs to be maintained

within narrowly defined parameters such as pH level, redox potential, and resistivity, in order to keep the body healthy (Chevalier, 2007).

pH level is determined by concentration of hydrogen ions. Biological functions like digestion and food absorption, activation of enzymes, and behavior of hormones are all pH-dependent.

Redox potential is a measure of the tendency of a molecule to lose or gain electrons, which translates into the capacity of a molecule to react. Interference with electron transport caused by chronic toxin exposure, viral, bacterial or fungal invasion will create a low energy state characterized by chronic fatigue.

Resistivity is a measure of the resisting power of a molecule to electron transfer. It is related to the level of minerals in extracellular fluids. Small amounts of several minerals are absolutely necessary to sufficient energy production.

The state of bio-terrain reflects what is going on inside the cells. In the case of blood, this can be translated into the statement that property of plasma mirrors the whole cellular dynamism of red blood cells (Chevalier, 2007).

Plasma concentration of fibrinogen has the greatest influence on the erythrocyte aggregation rate. Fibrinogen makes the red blood cells to stick together, which facilitates their rate of sinking (Malcolm L. Brigden, 1999). This relation appears to be positively linear, meaning that higher fibrinogen level causes higher erythrocyte aggregation, which translates into

higher ESR level. Fibrinogen is a soluble protein made by the liver, belonging to the group of acute-phase reactants. It is also a central component of the coagulation cascade.

Clinical usefulness of ESR stemmed from the observation that conditions associated with tissue inflammation or injury such as polymyalgia rheumatica, rheumatoid arthritis, systemic lupus erythematosus, serious bacterial infections, myocardial infarction, lymphomas and multiple myeloma among others, were known to cause marked elevation of ESR. It appeared under certain circumstances, that ESR levels were correlated with the severity of inflammation. Let's take an acute myocardial infarction as an example. ESR would go up in initial stage of heart muscle injury, and then the levels would come back to normal, days later in recovery phase (Wilson, 1990). In reality, this correlation was neither reliable nor predictable, and elevated ESR was not always the indicator of disease activity. Sometimes severe inflammation would only cause marginal elevation of ESR, or ESR would remain significantly elevated in spite of resolution of inflammatory process. This unexplainable unpredictability and unreliability limited usefulness of ESR in allopathic medicine to a very few conditions, and this test is presently being viewed as nonspecific indicator of inflammation or tissue injury (Malcolm L. Brigden, 1999).

There is one attribute of ESR though, that physicians uniformly recognize and acknowledge. It is the fact that the value of ESR invariably increases with aging even in healthy individuals. This elevation has no apparent reason (Oxford, 2019).

I posit, that oxidative stress is responsible for elevation of ESR in elderly patients.

Properties of Red Blood Cells

The second factor that influences the levels of ESR are red blood cells (RBC) themselves, especially their shape, size, and number. The cellular structure responsible for the maintenance of optimal properties of RBCs is its membrane. Red blood cells are the most "flexible" cells in the whole human body. They can easily change their shape from round to ellipsoid, which allows them to squeeze more easily through narrowest of capillaries. The proper deformity of RBC is maintained by specifically organized phospholipid cell membrane and cytoskeleton (Simmonds Michael J, 2013). Red blood cells, which lost their ability to deform properly are removed from circulation by macrophages. If significant amount of red blood cells is removed this will cause elevation of ESR. Shape of RBC is also maintained by proper cell water/electrolyte content. Again, the cell membrane is responsible for this function. Improper intracellular water content will alter the shape or RBC and make them clump easier, which will be reflected in elevated ESR.

The ability of red blood cells to aggregate is called a rouleaux formation. Rouleaux is enhanced in the presence of acute phase reactants, among which fibrinogen is the most significant; however, this expected positive correlation between the levels of fibrinogen and RBC aggregation is not always present, and sometimes an inversed relationship between them is noted. This means that RBCs have their own intrinsic ability to choose to aggregate, which is not dependent on fibrinogen level (Simmonds Michael J, 2013). Under physiological conditions it is the membrane that is the most influential in the degree of rouleaux formation. Healthy RBC

membrane means very little rouleaux formation, which should translate into low ESR level. The most significant process damaging RBC membrane is oxidative stress (Mohanty, 2014).

The other crucial aspect to proper understanding of behavior of RBC is knowing that Newtonian model of cellular biology, in which molecular reactions follow linear patterns in sequences of steps, does not apply to living cells. In any given cell, there are at least 100,000 chemical reactions taking place simultaneously each second. RBCs like all cells in our body are quantum mechanicals. The unique cell membrane structure with its inside non-polar regions, can indeed support quantum effects, says Professor Stuart Hameroff. All intracellular processes are based on quantum dynamics because electron clouds are present in all molecules. Atomic bonds in the molecules are not physical but energetic (Chevalier, 2007). Indeed, the research in the field of biophotons confirmed that majority of intercellular reactions occur faster than the speed of light (Dispenza, 2014, p. 192).

Properties or red blood cells, therefore, are not deterministic but probabilistic. Their behavior is the result of quantum possibilities of consciousness.

New understanding of hematology, expanded by concepts from quantum physics and quantum biology, is showing us that contributive role of fibrinogen and red blood cells into the outcome of ESR is of a two-fold nature. Fibrinogens levels correlate with ESR levels in linear way and represents its inflammatory aspect. This is a Newtonian cause-and-effect relation. On the other hand, the state of red blood cell membrane influences ESR in multidimensional ways

and represents its oxidative aspect. Oxidative damage to the membrane is a result of quantum superposition.

Chapter 9: Causal Relation Between Emotional and Oxidative Stress Protocol

Emotional stress is presently the number one factor affecting overall wellbeing, morbidity and mortality of our population. Because of its strong causality in pathophysiology of the majority of physical and psychological diseases, it is imperative that every healthcare provider not only understand its negative impact but is fully equipped with knowledge to tackle it quickly and effectively.

Enough research has been performed and published in support of the link between cellular oxidative stress and emotional stress. It is not a coincidence that most medical conditions are best explained on molecular level as caused by oxidative stress (Salim, 2014).

Why I Choose this Subject for My Study?

Dr. Paul Drouin, the founder of Quantum University, said something which sparked my medical interest: “The way we look at the blood matters”. In his statement, Dr. Drouin undoubtedly was underscoring the qualitative properties of blood rather than quantitative ones. As a physician, I am used to looking at the blood mostly from quantitative angle. Hundreds of

molecules that we are capable of measuring in the blood as part of diagnostic workup, have purely quantitative usefulness to a physician. Too much cholesterol, not enough potassium, too much iron, not enough thyroid hormones, are classical examples. Only infrequently, when suspecting pathology of blood cells themselves, we would look at the quality of blood by looking at the red blood cells, or white blood cells under the microscope. Throughout the Quantum Hematology course, Dr. Drouin gave us systematic, innovative presentation of the subject of blood microscopy, based on principles of quantum physics. He showed us that a drop of coagulated, dried blood observed under the microscope, did not have uniform pattern but its appearance varied depending on patient's health. Different medical conditions were correlated either scientifically, or empirically with specific coagulation patterns. The main reason for occurrence of different patterns, was severity of impact the free radicals, present in plasma, had on coagulation mechanism. Dr. Drouin also presented similar signs of oxidative damage while performing microscopic live blood analysis. Live blood analysis assesses primarily the shape of red blood cells (RBC), which is determined by the state of its membrane. Red blood cell membrane is extremely sensitive to oxidative stress, which causes its distortion and ultimately faster degeneration of RBC. In experiment which Dr. Drouin performed, he demonstrated that the shift in emotions to the state of peace, reversed the damage to the cell membrane of RBC caused by oxidation. This implied, that not only there is a relation between emotional and oxidative stress, but most importantly that it is possible to slow down or reverse the activity of free radicals in our bodies by changing the quality of our thoughts.

To develop the skills of microscopic quantitative blood analysis that Dr. Drouin possesses, one would need to dedicate countless hours of looking through the microscope lens at thousands of blood samples. With my busy medical practice, this was not a realistic option for me, therefore I asked myself a question: "Is there another way to objectively observe and demonstrate the impact of oxidation on the quality of blood that Dr. Drouin showed us?" I needed an aha moment to find the answer. "Seek and you shall find" whispered Jesus, and the moment came. I found my answer in ESR. Why ESR? Because the quality of blood indirectly affects the quantity of ESR. Better quality of blood - lower ESR. Lesser quality of blood - higher ESR values.

Introduction

Prevalence of emotional stress in present days is high and continuously rising. First step in harnessing stress, is developing the ability to recognize when we are under its influence. Our intelligently designed body, gives us clear signals whether we are emotionally stressed or not, and offers a solution at the same time. All we need to do is pay attention to how we feel. In a nutshell, body signals to us the lack of stress as a positive emotional state, and the presence of stress as a negative emotional state. At the same time, via existence of feedback mechanisms, positive emotions further reinforce an internal order, while negative emotions intensify an internal chaos. The human body has an inherent ability to self-regulate its emotional state, which means we can consciously choose positive feelings over negative ones. There are various ways

to positively influence the quality of our emotions. HeartMath Institute, the leader in research of relation between heart and emotions, tied the quality of emotions to the quality of heart patterns, and applied it in heart coherence biofeedback. Practicing heart coherence is an easy and effective way of reducing the impact of stress on the body.

The chemistry of positive emotions favors optimal homeostasis and reduction of oxidative stress.

Methodology

The purpose of this research was to demonstrate that conscious reduction of emotional stress can improve the parameters of physical health. My study was conducted from April 2019 till December 2019 and included 14 participants. It was designed to examine the impact the reduction of emotional stress has on reduction of oxidative stress. All agreed to participate in the study by providing written informed consent.

The biofeedback-style training sessions for emotional stress reduction were done using emWave Pro Stress Relief System, developed by HeartMath Institute. The objective was to achieve and maintain heart coherence by maintaining positive emotional state, utilizing the premise, that the state of heart coherence reflects the absence of emotional stress. The emWave Pro Stress Relief Systems consist of electronic pulse sensor and computer software, capable of processing information it receives from the pulse waves. During the training sessions the system continuously monitors heart rhythm and displays it on the computer screen in real time.

Participants learned how to visually distinguish between coherent, versus incoherent heart rhythm pattern and used this information to monitor and adjust their emotional state accordingly. In order to shift into on-demand positive emotional state, they used either Quick Coherence Technique (QCT), or Heart Lock-In Technique - both specifically designed for this purpose. If the monitor displayed incoherent pattern, the participants would work on adjusting their coherence technique. The presence of coherent pattern on the screen assured them of being in stress-free positive emotional state.

In addition to coherence training, 1-Minute HRV Deep Breathing Assessment and HRV Assessments were done, and were monitored for changes throughout the study. These assessments measure the amount of HRV.

The reduction of oxidative stress was measured indirectly by modified measurements of ESR. For this purpose, I used Autozero Westergren ESR System made by Globe Scientific Inc. All testing and blood handling were personally done by me. I predicted that the changes I was expecting to observe in my ESR measurement would be relatively small, therefore I increased the frequency of measurements to be performed on each sample. Instead of taking one measurement in one hour, which is done in standard ESR testing, I obtained four measurements on each sample, taken 30 minutes apart.

Demographics of Participants

Participant #1: 70 years old female, widow, retired. Significant medical history: hypertension. Medications: Valsartan-HCT.

Participant #2: 43 years old female, married, physician. Significant medical history: hypothyroidism, fatigue, emotional eating. Medications: Synthroid, Crestor, Elavil.

Participant #3: 38 years old female, single, teacher. Significant medical history: anxiety, depression, fatigue. Medications: none

Participant #4: 64 years old female, married, physician. Significant medical history: metastatic lung cancer, bilateral adrenalectomy, splenectomy, unilateral nephrectomy, distal pancreatectomy, bilateral salpingo-oophorectomy, fatigue. Medications: Hydrocortisone, Florine, immunotherapy bi-monthly.

Participant #5: 71 years old female, divorced, retired. Significant medical history: hypertension, hypothyroidism, diabetes mellitus. Medications: Amlodipine, Metoprolol, Levothyroxine.

Participant #6: 62 years old female, married, physician. Significant medical history: hysterectomy, bilateral oophorectomy, hypothyroidism. Medications: none.

Participant #7: 66 years old male, married, physician. Significant medical history: hypertension, primary hyperparathyroidism. Medications: Lisinopril, Nebivolol.

Participant #8: 75 years old male, married, retired. Significant medical history: hypertension, diabetes mellitus, depression. Medications: Losartan-HCT, Venlafaxine

Participant #9: 48 years old female, married, medical assistant. Significant medical history: hypertension. Medications: none.

Participant #10: 56 years old female, divorced, physician. Significant medical history: spinal laminectomy. Medications: none

Participant #11: 52 years old male, divorced physician. Significant medical history: none. Medications: none

Participant #12: 65 years old male, divorced, retired. Significant medical history: hypertension, DISH, chronic pain, peripheral vascular disease, hypogonadism. Medications: Amlodipine, Carvedilol, Clopidogrel, Losartan-HCT, Testosterone cypionate.

Participant #13: 74 years old female, married, retired. Significant medical history: sick sinus syndrome, depression, anxiety, emotional eating. Medications: Lexapro, Atorvastatin, Metoprolol, Digoxin.

Participant #14: 59 years old female, divorced, life coach. Significant medical history: breast cancer, intermittent asthma. Medications: Tamoxifen, Ventolin, Advair intermittently

Assessment of Stress Level

Baseline pre-study stress level assessment was done on each participant using The Ardell Wellness Stress Test. I chose this tool because of its holistic approach to stress. The test consists of 25 questions which incorporate physical, emotional, spiritual and social aspects of

health for a balanced assessment. The Ardell Wellness Stress Test was repeated after the final session. Full content of this test can be accessed at:

https://premierespeakers.com/donald_ardell/blog/2018/07/01/the_ardell_wellness_stress_self-assessment

Sessions Description

The entire research was conducted in six 1-hour training sessions. The sessions were scheduled at weekly intervals. Some participants due to their time constraints had their sessions at longer intervals. All participants finished all sessions.

Session #1.

- Written consent was obtained.
- Demographic data were collected.
- Baseline stress level was evaluated using *Ardell Wellness Stress Test*.
- Basic vital signs were obtained: blood pressure, pulse, respiratory rate, and pulse oximetry.
- The following concepts were explained to all participants:
    - What stress is and its negative effects on health.
    - Stress and autonomic nervous system: concept of fight-or-flight and rest-and-digest.
    - Relation between stress and quality of emotions.
    - Relation between heart and emotions.
    - Heart rhythm, heart rate variability and concept of coherence.

- Relation between quality of breath and coherence.
- Concept of biofeedback.
- Relation between quality of emotions and quality of blood.

- Initial assessment using emWave Pro Plus software was performed and included:
  - *1-Minute HRV Deep Breathing Assessment*. This is a challenge test which determines participant's capability for maximum vagally mediated HRV production. This assessment evaluates, records, and compares to the reference range the following measures: Mean Heart Rate, Mean Interbeat Interval, Mean Heart Rate Range, SDNN, RMSSD, and Normalized Coherence. During this assessment, HRV data was recorded for 1 minute, while a participant was consciously breathing as deeply as comfortably possible, at the rate of 6 breaths per minute. After the test was completed, the results were reviewed with the participant.
  - *HRV Assessment*. HRV was recorded in resting condition for the period of 10 minutes. This is a common approach to assessing HRV. This assessment includes full spectrum of HRV measurements - time and frequency domains. After the test was completed, the results were reviewed with the participant.
- Heart-Focused Breathing Technique (HFB) was introduced to a participant. This technique is the first skill taught, and it serves as a first step in all other self-regulation techniques. It is very useful in reducing the intensity of negative emotions and neutralization of stress. In this technique, a participant is asked to focus attention in the area of the heart and imagine his/her breath flowing in and out of the heart or chest area.

Breathing should be slower and deeper than usual. Inhale 5-seconds, exhale 5 seconds is suggested, or whatever rhythm is comfortable. Slow rhythmic breathing shifts heart into coherence.

- Two 10-minute coherence training sessions using Heart-Focused Breathing Technique were conducted. Results from both sessions were reviewed and explained.
- Participants were asked to practice HFB technique for about 10 minutes daily.

Session #2.

- Participants were asked about any changes concerning their perception of stress and a success in practicing Heart-Focused Breathing Technique.
- *1-Minute HRV Deep Breathing Assessment* was completed, and results were compared to the first assessment. Attention was paid to any noticeable improvement in measures included in this assessment.
- If participant felt comfortable with Heart Focused Breathing Technique (HFB), Quick Coherence Technique (QCT) was introduced. This technique builds on HFB technique and helps to initiate the emotional shift, towards more positive emotions. It is a "bread and butter" technique, meant to be used every day. It builds coherence, composure, and increases emotional resilience. It consists of two steps. The first step is identical to heart-focused breathing. In the second step, while doing heart-focused breathing, a participant made a sincere attempt to experience positive feeling such as love, gratitude, or appreciation.

- Two 10-minute coherence training sessions were completed using HFB or QC technique. Results were reviewed and explained.

Sessions #3 through 5.

- Each session started with 15-20 minutes conversation about any noticeable changes in stress perceptions, success with practicing, and any stressors going on. During sessions I strove for rapport with participants and offered personal insights into participant's ongoing stress triggers.
- *1-Minute HRV Deep Breathing Assessment* was done prior to coherence training session and repeated after both sessions in order for participants to learn slow, controlled breathing.
- If participants were comfortable with Quick Coherence technique (QC) they were introduced to Heart Lock-In Technique (HLI). This technique not only sustains personal energy and resilience but develops inner ability to radiate coherence field to others. Heart Lock-In Technique consists of two steps. Step one is the same as Quick Coherence Technique, and includes heart-focused breathing accompanied by activation and maintaining of positive emotional state. In the second step, a participant was making a sincere effort to radiate his or her positive feelings to others.
- Two 10-minute coherence training sessions were done using HLI technique or QC technique. Results were reviewed and explained. I noticed that only four participants felt comfortable with HLT. The other ten preferred to use QC technique during the sessions.

Session #6.

- First blood sample was drawn at the beginning of session and immediately placed in ESR measuring tube. Four separate readings were recorded at 30-minute intervals.
- About 20-minute conversation with each participant on subject of life, stress, and experience with HeartMath was done, and similarly to all previous sessions, included insightful personal advice.
- Two 10-minute coherence training sessions were done using QC or HLT technique.
- *1-Minute HRV Deep Breathing Assessment* was done prior to coherence training session and repeated after both sessions.
- Post-training 10-minute resting *HRV Assessment* was done and compared to initial one.
- Blood was drawn again immediately after second training session for second ESR. Four measurements were obtained at 30 minutes intervals, in a similar way to the first sample. All results were recorded.
- *Ardell Wellness Stress Test* was retaken at the end of the last session.

Results and Conclusions

Perception of stress.

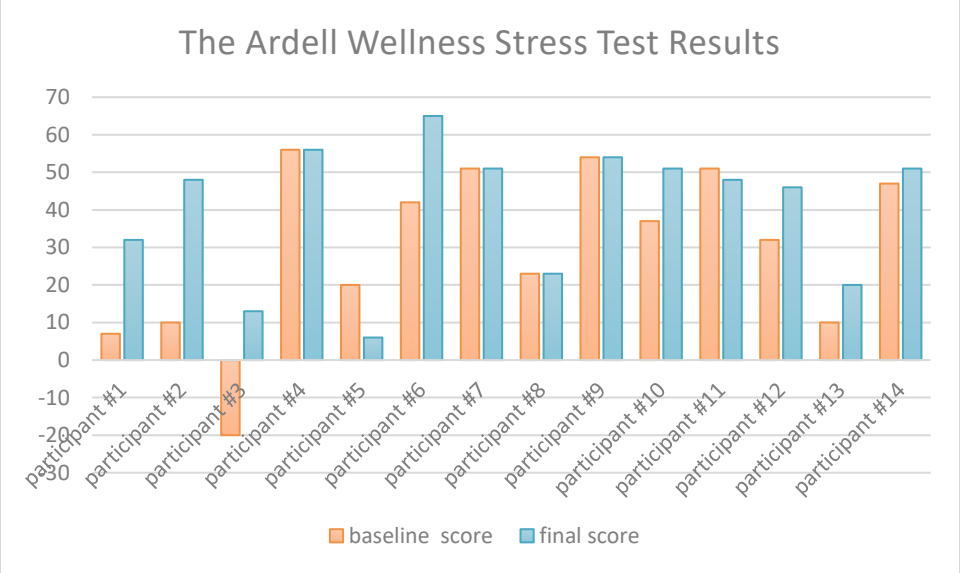

Figure 9.1 Ardell Wellness Stress Test results.

Figure 9.1 depicts cumulative results of *Ardell Wellness Stress Test*. Pre- and post-study results from each participant are comparatively graphed.

Eight participants *improved* their Ardell scores. Participants #1, #2, #3, and #6, improved their scores quite significantly, by 25, 38, 33, and 23 points respectively.

Four participants obtained *the same* score. Participants #4, #7, and #9, had their baseline scores above 50 which meant that they already had a good capacity to deal with stress. Participant #8 remained at his baseline score of 23.

Two participants *worsened* their score. Participant #11 worsened his score by 3 points. He attributed this to fatigue, he worked hard all day on this day. Participant #5 dealt with ongoing stressful domestic situation throughout the study, and her level of stress varied from day to day.

The overall results of this testing support the statement that stress is about perception of the situation.

Heart rate variability assessment data.

SDNN			Normalized Coherence		
Participants	Pre-study	Post-study	Participants	Pre-study	Post-study
participant #1	33.7	50.2	participant #1	54.7	58.4
participant #2	42	97.5	participant #2	39	72.9
participant #3	92.7	123.2	participant #3	59.1	80.4
participant #4	39.1	85.6	participant #4	30.1	25
participant #5	32.8	25	participant #5	55.1	61.5
participant #6	56	86.9	participant #6	68.8	79.2
participant #7	43.6	94	participant #7	58.7	45.4
participant #8	45.1	44.1	participant #8	59	36.9
participant #9	44.1	66.3	participant #9	38.4	63.3
participant #10	106	117	participant #10	35	67
participant #11	45.6	62.9	participant #11	44.2	70.3
participant #12	32.6	39.1	participant #12	43.3	52
participant #13	47.4	24	participant #13	26	32.5
participant #14	35	73	participant #14	39.7	47.9

Figure 9.2: HRV assessment data

The data presented in figure 9.2 were collected from *HRV Assessment*. HRV was recorded in resting condition for the period of 10 minutes. Initial assessment was done prior to initial coherence training and the final assessment was done after last coherence training session. NDSS and Normalized Coherence data from both sessions were analyzed comparatively and recorded in the table above.

SDNN is the standard deviation of the normal-to-normal (NN) sinus-initiated inter-beat-intervals measured in milliseconds. Out of fourteen participants eleven achieved improvement in their SDNN values at the end of the study.

Normalized Coherence: As a result of using emWave Stress Relief System, eleven participants improved their normalized coherence.

Dynamics of ERS measurements.

Prior to performing ESR analysis for this research, I conducted about 50 modified ESR measurements on random patients in order to achieve uniform technique and to minimize the measurement error. The results from 31 of them are pictured on the graph below. For the sake of clarity of my graphed data, I skipped ones that were repetitive.

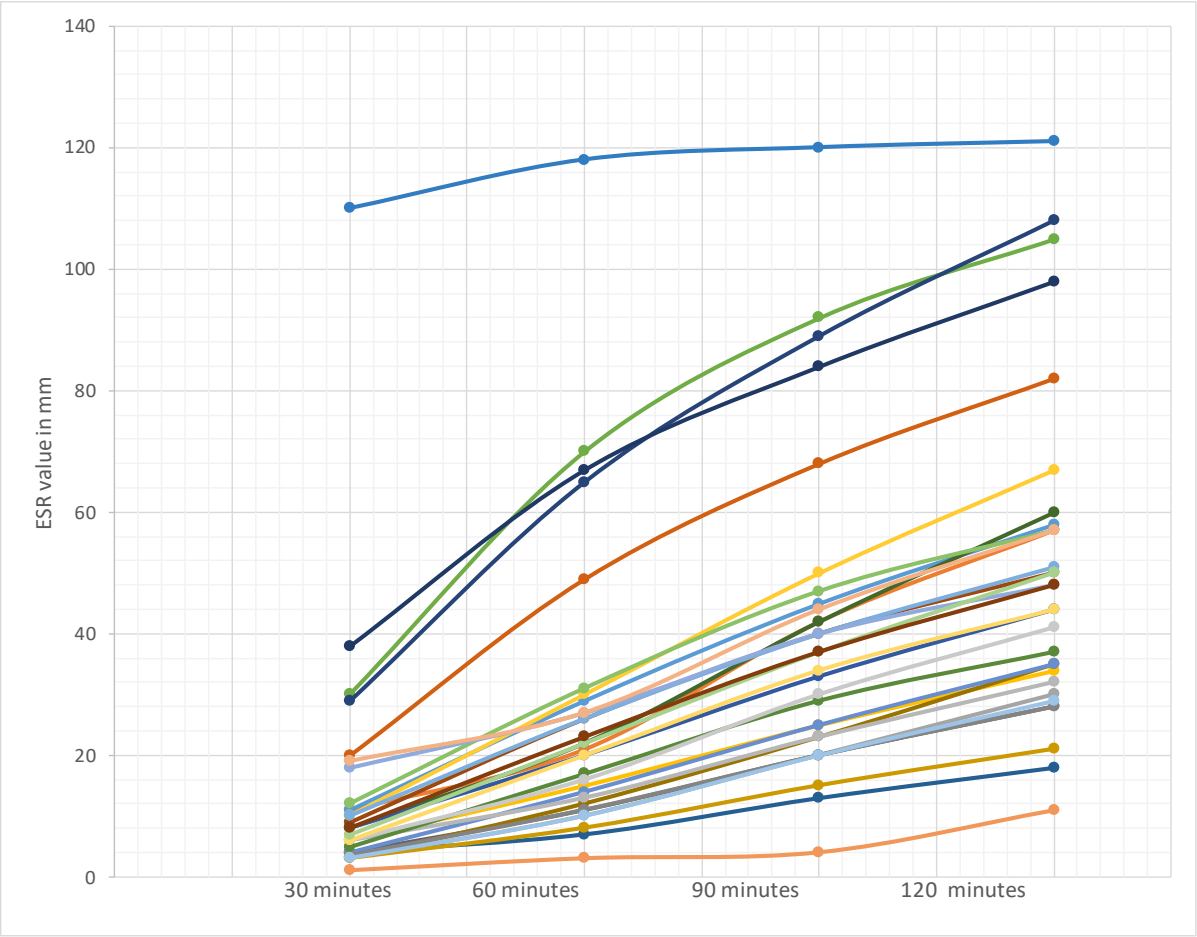

Figure 9.3 Dynamics of ESR measurements

Figure 9.3 represents 31 ESR measurements obtained from 31 patients. The most striking feature of this measurements is the lack of mathematical linearity.

From the above graph data, we can draw two conclusions:

1. There is correlation between variable of time and variable of distance. As the time increases so does the distance, but it is not a predictable relationship. The same value of ESR

in different blood samples at 30 minutes, does not translate into the same value at 60, 90 or 120 minutes. All measurements of ESR are probabilities. First measurement does not determine the last measurement.

2. Correlations between time and distance variables on each singular ESR graph cannot be solved with algebraic equation. The rate of red blood cells falling to the bottom of the tube is only approximately linear, which means it does not follow the mathematical determinism of Newtonian mechanics. Each individual graph has individual coefficient. It is a complex constant which is a reflection of living body.

This concludes that there is a natural amount of variability in humans making them probabilistic, not deterministic.

ESR results.

PRE-SESSION ESR DATA					POST-SESSION ESR DATA				OVERALL OUTCOME
30 min	60 min	90 min	120 min		30 min	60 min	90 min	120 min	
4	11	20	28	**participant #1**	6	14	22	31	worsened
8	27	45	58	**participant #2**	10	27	43	54	improved
4	9	16	23	**participant #3**	3	8	14	21	improved
14	32	57	73	**participant #4**	10	28	47	66	improved
20	43	64	76	**participant #5**	17	44	67	79	worsened
9	21	35	46	**participant #6**	5	16	28	39	improved
2	4	7	10	**participant #7**	1	3	5	0	improved
3	7	11	16	**participant #8**	2	5	10	15	improved
9	26	42	54	**participant #9**	8	25	40	52	improved
3	7	13	20	**participant #10**	2	6	13	19	improved
3	5	10	15	**participant #11**	2	5	10	15	no change
3	8	14	20	**participant #12**	3	7	12	17	improved
10	24	37	47	**participant #13**	10	26	40	50	worsened
3	5	10	14	**participant #14**	2	5	8	12	improved

Figure 9.4: Erythrocyte Sedimentation Rate results.

Figure 9.4 represents the ESR data of all participants. It contains results of four ESR measurements, collected at the beginning of the last coherence training session, and then again, results of four measurements collected immediately at the end of the last coherence training session. The far-right column indicates whether improvement or worsening in ESR values was observed.

I found the results and the behavior of ESR in my research absolutely astounding. Although it included relatively small number of participants these results could not have been all

random. Ten participants improved their ESR values, one participant's ESR did not significantly change and three participants worsened their ESR.

Participants #4 and #6 were clear outliers in this study and both showed very significant *improvement* in their ESR values.

Participant's #4 measurements reached 14 mm in 30 minutes, 32 mm in 60 minutes, 57 mm in 90 minutes, and 73 mm after 120 minutes. After her last training session, the results at the same time intervals were 10 mm, 28 mm, 47 mm, and 66 mm respectively.

Participant #6 started with 9 mm in 30 minutes and then went to 21 mm, 35 mm and 46 mm after 120 minutes. After coherence sessions her numbers were 5 mm, 16 mm, 28 mm and 39 mm.

I compared their demographics and psychological profiles to see why these two participants performed so well. Participants #4 and #6 are both females and almost of the same age (62 and 64 years old respectively). They are both practicing physicians, they are both mothers of four children and their husbands are physicians. They are both women of faith, who have personal relation with God. They both pray and attend church regularly. They both scored very well on Ardell Stress Test, which means that in spite of their demanding professional and personal lives, they do not perceive life as too stressful. In spite of all these similarities they were also significant differences between them.

Participant #4 has stage 4 lung cancer of neuroendocrine origin, diagnosed 5 years ago. She is miraculously alive by taking just immunotherapy for last 2 years. She knows she is alive

by the grace of God and she totally surrendered herself to His will. Her fear of death is almost totally replaced with loving trust in His divine plan for her. She did not score well on coherence numbers but improved her SDNN. She had no experience with biofeedback before but enjoyed the sessions very much. It was easy for her to generate outward oriented positive emotions.

Participant #6 has no acute or chronic health issues. She is familiar with biofeedback and practices her sessions regularly. She improved significantly her SDNN and coherence scores as a result of participation in this research. She also has the ability to generate strong outward oriented positive emotions.

Some common characteristics of the remaining eight participants who *improved* their ESR scores.

- Three participants had high initial Ardell score.
- Four participants with low initial score improved their final Ardell score significantly as a result of participation in this study.
- One participant had low Ardell score, which did not improve.
- All participants were easily able to generate outward directed positive emotions.

Participant #11 had exactly *the same* ESR measurements in both blood samples. As per participant's request I ran the second set of measurements in two separate tubes to see if there was a randomness factor in ESR behavior. Both sets of tubes showed identical behavior and fell at exactly the same rate, which I documented by taking pictures at 30 minutes intervals. This

participant scored well on both Ardell tests. He did struggle with generating the outward positive emotions.

Three participants *worsened* their ESR scores in my study. Participant #5 and #13 had very low initial Ardell score with participant #13 achieving slight improvement and participant #5 worsening her Ardell score. Both were dealing with significant ongoing personal stress and both struggled with achieving outward directed positive emotions. Participant #1 started with low Ardell score but raised it significantly at the end of the study. She also dealt with ongoing personal stress and was greatly affected by "fear of the unknown". She had a problem generating strong positive outward emotions as well.

I am not sure how to explain worsening of the ESR in participants #1, #5 and #13. Maybe the connection I had with these three participants was not as strong as I had with the others? Or, perhaps added stress of performing well during coherence sessions added more fuel to the fire, and the red blood cells responded promptly to the message received.

Strengths and weaknesses of this research.

*Objectivity***:** This study was based on objective measurements such as ESR, SDNN, and normalized coherence. Although all the results were carefully obtained, objectivity of these results is to a certain extent limited, simply because of limitations of quantitative methods in general. Every measurement is subject to uncertainty because all instruments are subject to external influences. Accuracy of my ESR measurements were to some degree affected by the

precision of multiple steps involved from the moment the blood was drawn till it was placed in Westergren's tube, and limited by the smallest division on the tube. I made every effort to preserve its objectivity and minimize the above-mentioned limitations.

*Reproducibility***:** this is a straightforward study with ability to be fully reproducible**.**

*Ease of Learning***:** Knowledge how to use the emWave software and how to develop sessions protocols is required. Blood drawing and handling skills are necessary for this study.

*Weakness***:** The biggest weakness was lack of previous data and lack of control group. I have not been able to find any documentations of any studies looking at ESR as an indicator of oxidative stress, so I had no data to compare my study to. I hope to repeat it in the future on the larger scale, with inclusion of control group. Maybe then ESR would be recognized as an anti-oxidant marker?

Final Thoughts

The way we look at things matters, said Dr. Drouin. Why so? Because, "*things are not always what they seem: the first appearance deceives many; the intelligence of a few perceives what has been carefully hidden"* echoed Phaedrus. If I did not choose to look differently at the emotional stress, oxidative stress, and erythrocyte sedimentation rate, this dissertation would have never been brought to existence.

On first appearance, erythrocyte sedimentation rate is an inflammatory marker, having its value determined by fibrinogen level. On first appearance, an emotional stress is just a mental state, with no bearing on our physical health. On first appearance, oxidative stress is all about exposure to dirty air, water, and food. On first appearance, erythrocyte sedimentation rate, emotional stress, and oxidative stress are the separate pieces of different puzzles. But things are not what they seem, indeed. They all have hidden features waiting to be discovered.

What have I discovered about ESR through my research? First of all, ESR measurements proved to be probabilistic not deterministic. While fibrinogen level gives ESR strong deterministic trait, the red blood cells make the overall measurements probabilistic. Their quantum behavior is the result of conscious choice. Now, I don't have to see the ESR as an obsolete test with limited clinical usefulness. I can look at it as a test which can indirectly measure the ability of the human mind to influence its state of health.

Red blood cells modulate ESR with the state of its membrane, which is mostly affected by oxidative stress. This is the key connection between ESR and oxidative stress. My research made me broaden the concept of oxidative stress. For practical purposes, stress is classified as physical, chemical or emotional, but regardless of the initial cause of stress, the final effect is the same. Stress leads to dysregulation of cellular homeostasis which raises the level of reactive oxygen species (ROS). In other words, *all* stress is oxidative stress, including the emotional stress. In fact, it is the emotional stress which is a main cause of overproduction of ROS. Elimination of emotional stress, in terms of body oxidation, is more beneficial than breathing unpolluted air, drinking clean water, and eating organic food.

This research additionally presented the updated view of emotions and emotional stress. In formulating this part, I drew almost exclusively on scientific wisdom of researchers from HeartMath Institute. Their valuable contribution into understanding the heart-emotions relation came with simple, practical clues to emotional stress recognition and pointed towards ways of developing personal ability to eliminate stress.

In a significant number of my research participants, reduction of emotional stress achieved by practicing heart coherence, improved their oxidative state, which was reflected in improved ESR measurements.

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