Science, God and the Nature of Reality

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Bias in Biomedical Research

Sarah S. Knox

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To Eje, Mary, Judy, Robin and Eloise

♦

May their suffering not have been in vain

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INTRODUCTION
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PREMISE AND HYPOTHESES

> "...everyone who is seriously involved in the pursuit of science becomes convinced that a spirit is manifest in the laws of the universe, a spirit that is enormously superior to that of human beings, in the face of whom we must reflect humbly on our modest powers."
>
> —Albert Einstein [I.1]

The purpose of this book is to begin a scientific dialogue. The subject of the dialogue is the existence or non-existence of God as a legitimate focus of scientific inquiry. The book does not purport to prove the author's opinion concerning God's existence, but rather to clarify the fact that the prevailing assumption in scientific circles that God does not exist or is irrelevant to the pursuit of scientific knowledge, is a cultural belief not a fact supported by scientific data. However, this belief is so pervasive that it has become axiomatic in every field of scientific research, sculpting the nature of the questions scientists ask and the variables they include as potential explanations in scientific investigations. It is therefore, a potent and unresolved issue.

Let us examine why. A current axiom in the field of medicine is that living organisms originated from inorganic matter that, through a series of undetermined circumstances (e.g., temperature, chemical mixtures, surrounding environment, electrical storms, etc.) randomly evolved into a living cell which became the source of all life. Through some as yet undefined process, this cell gained the ability to reproduce itself and through random mutations evolved through many plant and animal stages to become human beings. Thus, the source (cause) of not only our body, but our thoughts, feelings and cognitions is particulate matter. It is assumed that the organs and systems in our bodies are made up of small particles of matter and that the most logical way to study the origins of disease is to begin with the smallest possible unit and extrapolate from there to the diseased system. It is assumed that if one can understand what has gone wrong with the subunits such, as a cells, receptors, neurotransmitters, DNA, etc., one will be able to understand the cause and treatment of the disease itself. Given the premise that the whole is no more than a sum of its individual parts, this is certainly a logical approach. Referred to as "reductionism," it is also the most common investigative approach in biomedical research. If one believes that understanding a complex system can best be achieved by studying its smallest individual components, it would not make sense to try to understand a diseased organ by beginning with an examination of systemic functioning in anything other than the diseased organ, and certainly not by inquiring about the ill person's recent life events or emotional state because the cause of the problem is assumed to originate locally, in some physical part of the organ that is manifesting the disease. Causality is seen as unidirectional, emanating from a localized malfunction, such as a gene, receptor, signaling pathway, mutated cell, or diseased organ but having the potential for spreading to other parts of the body. The possibility that imbalance in the integration of multiple complex systems could be the cause that allows what would otherwise be an easily repaired malfunction to progress to the stage of disease (such as a tumor) in a single organ, is not consistent with the reductionist approach nor with the fundamental tenets of current biomedical research.

If the scientist investigating the disease is not a reductionist, s/he believes that the whole is more than the sum of its parts. This means that the system has properties that cannot be extrapolated from its individual components. Such a scientist might take a more holistic approach to the investigation of disease. Assuming that humans are complex physical, psychological, emotional, (and spiritual?) beings, this scientist might begin by asking what part of the complex system is out of balance when symptoms appear and why the disease is manifesting in that particular part of the body at that particular point in time. The latter approach would only be utilized if one believed (hypothesized) that physical and emotional aspects of "humaness" are so intertwined that examining only the physical aspects of one small part provides insufficient information to fully understand why a particular individual is ill at a specific point in time. Let us take the example of "strep throat". We know that streptococcal bacteria are associated with this illness and can identify them easily under a microscope. What is less clear is why when two healthy people are exposed to these bacteria in the same manner, only one becomes ill. Traditional medicine would say that the immune system was probably compromised in the person who became sick due to lack of sleep or poor diet. Although stress also influences immune function, asking questions about a patient's life situation is almost never part of a routine physical examination. Given the large number of bacilli with which the average person comes in contact on a daily basis, and the relatively healthy state of most individuals, one has to acknowledge, that for the most part, the immune system is a very effective "watch dog". So when someone becomes ill, one can certainly limit treatment to an antibiotic, if it is a disease which responds to antibiotics. But having some insight into why the immune system is not responding as well as it should at a particular point in time, can also help to identify other factors contributing to disease vulnerability and promote preventive measures that will avoid a recurrence in the future.

Research into the influence of emotions and cognitions on physiological functioning has been the purview of Behavioral Medicine for several decades but has never been fully accepted or integrated into the thinking of the biomedical research community [I.2]. I believe that there is an underlying reason for this. The reductionist viewpoint posits the whole as simply the sum of its parts, which in turn, are composed of particulate matter. If causality is unidirectional, i.e., goes from the smallest to the largest, and matter is the only cause, then thoughts and feelings cannot possibly have any meaningful influence on physiological functioning. (The belief in matter as the sole cause of everything is referred to as "materialism" by theorists and differs from the more common use of the word "*materialism*," which refers to a value system focused on accumulating possessions.) The materialist / reductionist approach to science differs radically from the holistic point of view that is based partially on complexity theory. The holistic approach is that matter not only influences thoughts and feelings *but can be influenced by them*. In the specific case of a streptococcal infection, the holistic approach would consider the fact that thoughts and feelings such as stress can cause changes in the neuroendocrine chemistry of the brain, which results in a cascade of changes influencing immune function. Therefore, the holistic approach would ask not only whether a streptococcal culture is positive, but why the immune defenses are not capable of defending against it at that particular point in time. What implications do these different approaches have for treatment? In the reductionist approach, one would undoubtedly turn first to antibiotics to cure the strep infection. The holistic approach would probably also recommend antibiotics as the first step in treatment but might also attempt to ascertain why the immune system had failed (e.g., diet, stress, passive smoking, lack of sleep, etc.) and how this could be prevented in the future. In the case of recurring childhood illnesses such as earache, the latter approach might provide additional benefit.

The way that beliefs influence scientific inquiry can be further elucidated by contemplating the most common approaches to understanding human thinking and consciousness. The reductionists posit that the brain, neurochemicals and nerves are the cause of thought. They describe in detail blood flow changes in different parts of the brain, the chemical changes involved in the propagation of a nerve impulse: e.g., how potassium and sodium are transported across the membrane, the role of calcium channels and multiple chemical changes involving neurotransmitter substances that occur at nerve endings and in the synapses between nerves. However, there are no data that relate the voltage across the nerve or the amount of a specific neurotransmitter at the end of an axon to a specific thought. No data exist that would indicate that the propagation of a nerve impulse along an axon in the process of thinking about a chocolate cake recipe differs in any way from a nerve impulse created by reflection on a Shakespearean sonnet or a porno movie. In fact, I know of no neurophysiological research that has ever explicitly defined what a thought is.

The fact that neurophysiologists have not even come close to defining thought seems strangely, to be of little concern to them or to any other field of neuroscience or psychiatry involved in describing brain function or treating mental disorders. We know that there are particular areas of the brain associated with visual, auditory, emotional and other processes. But we cannot define thought. We know that a state of emotional distress is associated with changes in the chemistry of certain areas of the brain, such as the locus coeruleus, hypothalamus or pituitary, and that these areas are connected to other parts of the body which can result in a cascade of nervous system and endocrine influences on areas such as the cardiovascular and immune systems. The data also indicate that there is reciprocity in these functions such that changes in brain chemistry can affect the way one feels and that feelings can cause changes in brain chemistry. Thus, negative thoughts and feelings can cause chemical imbalance in a previously healthy system, just as chemical imbalance can cause negative thoughts and feelings. However it is not possible to look at the amount of a particular neuroendocrine secretion and know what the person was thinking or experiencing. Other mammals with similar neuroendocrine secretions do not think like humans, nor do they have comparable intelligence, which leads to the conclusion that these chemical changes might not be a sufficient condition for thinking to occur.

If thoughts and feelings can change chemistry, but we cannot reduce thoughts and feelings to chemistry, then logic suggests that either there must be important, as yet undiscovered chemicals that explain these processes or that maybe we should be seeking the answer elsewhere. One possibility is that patterns of electrical impulses associated with thoughts, that is to say, varying wavelengths of electromagnetic fields (energy) in interaction, might in some way be important to understanding conscious thought. An even more radical possibility is that mind, like matter (as defined by quantum theory), is non-local (i.e., not confined to the brain). These are radical concepts that will be explored more deeply in the remainder of this book.

If we step back for a minute to examine what science is really about, its purpose is to try, to the best of its ability, to explain the nature of reality. The more accurately we can do this, the more problems we will be able to solve and the more our research will benefit humanity. The premise of this book is that there are major differences in the way that modern physics and the biological / medical sciences define the essence of reality and that it is time to step back and take a look at the consequences of this divergence. The lack of knowledge among biomedical scientists concerning what has been experimentally demonstrated in modern physics is creating a bias in the biomedical approach to research. If our scientific questions are biased by our personal beliefs, the process of science and thus, the conclusions that we draw will be flawed.

To further illustrate this, we might ponder how a scientist with a materialist / reductionist viewpoint and one with a holistic view would go about trying to predict how a building would react under conditions of strong wind. Just as a biomedical reductionist might try to understand a particular disease by examining the molecular structure of a diseased organ, the engineer using a reductionist approach might begin by examining whether screws with the appropriate composition, width and length have been chosen for the material in the frame. If these seem to be adequate for the size and strength of the weight they must bear, then the steel beams might be the next level of investigation, and so it would continue through choice of windows, doors, etc. until all the individual building components had been examined. The holistic theorist, on the other hand might begin by looking at the blueprint of the building to see whether the construction design was appropriate for the geographical region and weather conditions in the location intended for construction. Is this an earth quake zone? If so, does the design allow for movement? Does it need to be changed to accommodate periodic flooding? Translated into the realm of biomedical research, the holistic scientist would assume that there is a systemic response when the body is confronted with a disease pathogen, and that the most logical way to solve the riddle of a particular disease would be to understand how the subsystems interact with the whole when the body is exposed. Since the immune system, DNA repair mechanisms and mechanisms of programmed cell death (apoptosis) are facile enough to respond to foreign invaders, we do not usually develop symptoms or become ill as a result of mistakes in DNA replication, renegade malignant cells, or the plethora of bacteria and viruses to which we are exposed in our daily contact with the environment. Nor do we usually get cancer from the mutational "mistakes" made in the continually ongoing process of cell division that replaces aging cells. When the coordination and feedback between various defense mechanisms of the body are working properly, the 'marauder' cells or mutations are sought out and destroyed, and we are none the wiser. This example illustrates that different assumptions about causality can lead to different investigative approaches and to the inclusion of different variables in the experiments.

What should by now be clear to the thoughtful reader is that both of these methods, namely, studying the individual pathogen and investigating the host system, supply us with important and useful information for trying to understand the cause and find the cure for disease. Employing one method to the exclusion of the other, will obscure important data and leave us with incomplete answers and suboptimal treatments. Yet, there is a subtle bias in biomedical research, which has caused the primary emphasis to be placed on the disease-causing agent and on analyzing the response at a molecular or organ specific level, while ignoring the integrated systems that provide the functional context of the body's defense against illness.

Returning to the concept of how our belief systems influence the way we conduct scientific research, most scientists seem to be in agreement that the cosmos and life on earth evolved as a result of random events and that design was not involved. Since there is general agreement on this point, one would assume that there was also abundant scientific data to support it. Indeed, there is abundant data to support the concept of evolution from simple to more complex organisms and data that supply information concerning which species came first and approximately when in the earth's evolutionary history different species emerged. However, to my knowledge there is no data whatsoever that would support a theory of randomness vs. design. Dominant theories concerning the origin of life are still unsubstantiated and without supporting documentation. In other words, they are based purely on speculation. The fact that most scientists adhere to the former belief (randomness) and most religious people to the latter (design), does not change the fact that neither can be proven with scientific evidence. Therefore, although most scientists would insist that they are "objective" and that they approach scientific questions with an open mind, one of the most fundamental assumptions of current scientific theories is founded on conjecture.

For centuries, there was general agreement in European thought that God had created the universe and everything in it. It was the task of the learned to figure out how it worked. However, when data began to contradict the teachings of the Catholic Church, science began to emerge as a school of thought separate and distinct from religion. A major split occurred with the teachings of Copernicus and Galileo, whose views that the earth was not the center of the universe were rejected by the church because they disagreed with its doctrine. Galileo's telescopic observations of the heavens and subsequent calculations concerning celestial movement supported Copernicus's theory that the earth rotated around the sun rather than the sun around the earth. He was condemned by the inquisition for supporting the Copernican view and was silenced for the remainder of his life. Religion and science were no longer compatible.

Newton, too, believed in God, but despite his belief in God's role as creator of the universe, his physics, describing general principles for how energy and matter interacted, seemed to make the existence of God irrelevant. *If* one refrained from asking how these principles came to be in the first place (and one did), one could eliminate God from the equation altogether. The world as Newton knew it functioned according to invariant principles, like a clock, and these principles could be understood on their own merit without invoking intervention from God. The subsequent work of Darwin on the "survival of the fittest" principle of evolution and Mendel (genetic inheritance) cemented materialism as the scientific explanation for the nature of reality.

What has changed since Newton and Darwin is the discovery and experimental validation of quantum mechanics. Quantum theory turned the materialist view of reality on its head by showing that at a subatomic level, distinctions between matter and energy blur. In fact, one of the most well-known quantum physical experiments showed that whether light consisted of particles or waves (matter or energy) depended solely on how the experiment was set up. This completely contradicted the world of Newtonian physics, which defined reality as an objective state, totally independent of the observer. The problem presented by quantum theoretical experiments was that on a subatomic level, the little building blocks of matter disappear, as energy and matter become two aspects of one and the same reality. Furthermore, whether reality appears as particles or waves, depends on how the measurements are made, implying that there is no 'objective reality' apart from the observer. The enormous implications of these principles have gone unrecognized by the field of biomedical research. The consequence is that the primary theoretical framework of biomedicine, namely materialism, is more than 80 years out of date. The purpose of this book is to discuss these developments and to call attention to the gap between the nature of reality as defined by experimental data from modern physics and the belief system that still poses as science in the fields of biology and medicine. The fundamental basis for refusing to acknowledge the scientific relevance of the question of Divine design vs. randomness in evolution is the doctrine of materialism, which is no longer a valid scientific theory. Despite the predominant belief to the contrary, the question of God's existence or non-existence is still unresolved.

So what relevance does this have for science? Our beliefs influence not only the questions we consider worthy of scientific inquiry, but also the methods we use to investigate them. The subatomic blurring of the distinction between matter and energy raises challenges to many of our most cherished assumptions, not the least of which is our tendency to attribute all causality to matter. Einstein long ago showed us that matter and energy are interchangeable. What quantum theory leaves open is the distinct possibility that energy may actually be primary and matter secondary. Does energy "congeal" (for lack of a better word) into matter at a lower vibrational level or are matter and energy always co-existent? The lack of mass in a photon opens the intriguing possibility that energy may be primary. What implications do these issues have for evolution? If quantum theory illustrates one thing, it is that there are no indestructible bits of matter that constitute the basic building blocks of all substance. This being the case, where does causality lie with respect to life? The issue of design in the universe is still unresolved and so is the issue of God's existence. Like many other formerly philosophical problems that made the transition into the scientific realm as we developed the methodology to investigate them, the issue of God's existence is one that should no longer be left to the purview of philosophy and theology. The implications of this question for human existence are simply too momentous to be ignored by science. Whether or not there is a God and the role (if any) that this God plays in the universe is the most important scientific issue in existence because it is fundamental to everything else we are trying to understand.

Beliefs about the origin of the universe, e.g., whether its laws were developed randomly or as part of a complex creative process orchestrated by design, have important implications for how we structure scientific inquiry and the methodology we use to investigate the nature of reality. If the majority of scientists have the same belief system and this belief is incorrect, the process of scientific discovery will be seriously impeded. For this reason, it is important that those of us who are scientists become aware of and openly acknowledge our beliefs and begin to reflect on the manner in which they might influence the framework of our scientific questions.

The scientific term for unproven beliefs about the nature of reality is "hypotheses." Hypotheses are theories that we generate to explain the nature of observed phenomena whose origin or function we do not fully understand. When we have observed phenomena that puzzle us, we reflect upon them in the context of what we already know and what we believe. Both knowledge and belief influence the way we formulate hypotheses to explain the phenomena, and also the way we design experiments to test their validity. In the formulation of hypotheses, we exercise logic to put the new phenomena in a context that makes sense. Scientific bias influences not only scientific method but also the very questions that are deemed relevant to ask. Because the purpose of this book is to help scientists get beyond their biases through the process of acknowledging them and contemplating the influences these biases have on their research, I will begin by stating my own.

My hypothesis is that the fundamental causality of the universe and of the principles determining its function is Mind (Collective Unconscious, God). I also believe that humans have a divine aspect or "soul" which is their essence and which allows them to become co-creators with God. This belief system is important for my approach to scientific investigation because it influences the questions I see as scientifically relevant (e.g., different forms of energy healing). Because a major assumption of biomedical research, i.e., materialism, has been disproved but not discarded, I believe that it is time to examine the consequences that scientific bias has for scientific inquiry.

There is another primary assumption underlying research in the biomedical sciences, namely the assumption that God is either non-existent or irrelevant to our scientific understanding of the nature of reality. Although I can find no data to either prove or disprove this assumption concerning God's existence, it is axiomatic in biomedical research. The frame of reference created by this assumption determines the selection of relevant lines of investigation, methodological approaches and variables that are included in experiments and equations. Just as my beliefs influence the scientific questions I am asking, the materialist belief system of mainstream science influences the questions it asks *and those it chooses not to ask.* The questions not being asked and the consequences of not asking them are the topic of this book.

I have formulated my hypothesis concerning God's existence as a theory to explain my observations. It occurred after many years of agnosticism and lack of interest in the question, when continued reflection on the nature of reality as reflected in the laws of physics, coupled with the biological data I was observing, finally made non-belief too difficult to sustain. I encourage scientists with opposing views to express their own hypotheses (belief systems) along with the data used in their formulation. My expectation is not that we will then "have the answer" or be able to construct the ultimate experiment to test the existence of God, but rather that the process will result in the pursuit of new scientific questions and an increased understanding of how our beliefs are influencing the way we conduct scientific research. The objective is to broaden the scope of the scientific questions we are asking, and hopefully, to increase the benefit of science for humankind.

The remainder of the book will be devoted to a description of my scientific journey in hopes that it will open the question of God's existence, as well as the implications of this question, to legitimate scientific inquiry. I believe that a constructive dialogue on this subject could lead to research that has the potential for greatly benefiting humanity.

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Chapter 1

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The Nature of Reality: Implications for Scientific Inquiry

1.1. Definition of Matter

> "We can say that all particles are made of the same fundamental substance, which can be designated energy or matter; or we can put things as follows: the basic substance 'energy' becomes 'matter' by assuming the form of an elementary particle."
>
> —Werner Heisenberg [1.1]

We have said that the goal of science is to describe as accurately as possible the nature of reality. The goal of medical research is to utilize its discoveries about the nature of living organisms to benefit humanity through helping to design clinical interventions and technical products that improve the quality and length of human life. Since the objective is to understand the nature of reality, and since our bodies and the things around us are composed of matter, we will begin with matter. According to classical physics, matter consists of little units called atoms, containing a nucleus surrounded by electrons. Modern physics has since demonstrated that there are even smaller particles, and even stranger, that matter can also assume the characteristics of a waveform (energy). In fact, at a subatomic level, whether we observe a particle or a waveform depends entirely on the way we set up the experiment. This phenomenon is called "wave / particle duality". In concrete terms, it means that light appears as particles if you measure it one way but as waves if you measure it another way. Modern physics tells us that this is not due to measurement error but to the inherent nature of reality, which does not assume the form of matter or energy until the moment of measurement. If what we are measuring does not become a particle (matter) or a wave form (energy) until we measure it, then *there is no "objective" reality out there.*

How is this possible? It is completely counterintuitive and implies that the "essence of reality" is totally inconsistent with the world that we have come to know through our five senses. We saw a sofa in our living room yesterday and it is still there today. Is this not proof of an objective reality? The whole concept appears to be nonsense. "Objective" reality (e.g., the sofa) sure seems to be where we left it yesterday. Is this wave/particle duality stuff just philosophical 'gobbledygook' or is it really relevant to our daily lives? The answer is that it has all the relevance in the world for how we are conducting biomedical research and the reasons will unfold as the book progresses.

The discrepancy between what we perceive with our five senses and what experiments have verified to be true on a quantum level, stems from the fact that our senses have evolved to serve as practical tools for navigating the daily tasks of lives lived in a 'macro', rather than a subatomic world. They simply do not have the precision to perceive what happens on a subatomic level without the help of additional measuring instruments. The eyesight that helps us to steer a car while we are driving and to cross the street without being hit, is not sensitive enough to allow us to distinguish very small objects, such as bacteria, without using a microscope. This is probably a good thing because what we need to function effectively is the ability to simultaneously observe large areas of our surrounding environment. Just imagine where we would be without peripheral vision. If our eyesight could zero in on activity at a subatomic level, we would be focusing in the same way that one does with a microscope, i.e., on a very tiny spot. We would lose the ability to take in our surrounding environment and thus, be totally oblivious to that truck coming down the street that we are beginning to cross. Our chances of survival would be greatly reduced. The analogy can be made to standing on a hilltop and looking through a camera lens. If we use the camera without the zoom lens, we see a broad landscape, including the tornado heading our way. If we zoom the camera in on a flower in the distance, it looks very beautiful but we miss the tornado altogether. We need to be able to see the tornado. Our eyes function like the lens without a zoom.

So, although we may know from scientific evidence that the separation between the nucleus of an atom and its surrounding electrons contains a great deal of empty space, we have difficulty conceptualizing it because our vision tells us something different. To us, the chair looks solid. We are accustomed to thinking that there are objective bits of matter "out there" whose existence is independent over time, so that they will be the same whether we measure them today, tomorrow, or next week. However, the Schrödinger equation, which provides the most accurate way of predicting the probable state of a measured particle, says something about the nature of reality at a subatomic level that is difficult to grasp. It says that it is basically a linear superposition of *possible* states. That means that the best prediction for finding an atom at a particular place at a particular point in time is the sum of all the possibilities, each multiplied by its probability. So, theoretically, there is a possibility that an electron that is currently in my body may be orbiting somewhere in the vicinity of the moon within the next two minutes, but this is highly *improbable*, given its current position. The possibility multiplied by its probability (e.g., its current location, the distance to the moon, the speed it would have to travel to get there in the next two minutes) results in a highly unlikely occurrence, and one that would be negligible when summed into Schrödinger's equation. The probability that the same electron will still be somewhere in the vicinity of my body would have a much higher probability and thus have more "weight" in the equation. So, although the probability of an electron being at a particular place at a particular point in time is essentially infinite, it decreases drastically with divergence from immediately preceding measured states. At the time of measurement, the multiple possibilities "collapse" into one state (e.g., particle or waveform), determined by a combination of the point in time when the measurement was made, the method of measurement, etc. At the time of measurement one potential state becomes an actuality with specific parameters, while the others disappear as possibilities.

We influence what we measure because the more precisely we measure location at a specific time, the less accurately we can measure the velocity, and vice versa. To measure the location of an electron requires shining a beam of light on it so we can see it, but in so doing we perturb (influence) what we are trying to measure. The smallest unit of light possible, which is required for the most precise measurement at the subatomic level, is one photon. The wave probability associated with this single photon is short (i.e., high frequency) which means that its power to knock the electron at the time of measurement, and change its velocity is high. So by measuring its position with precision we simultaneously change its velocity, making that measurement less precise. Either we can measure the position at a particular point in time with exactness or the velocity can be measured with exactness, but not both. The more precisely we measure one, the less exact will be our measurement of the other.

It was originally thought by some physicists, including Einstein, that even though the Schrödinger equation is the most accurate way we have of predicting future events at a subatomic level, this way of defining reality was really the result of a measurement problem. These scientists believed that there really was an "objective" reality out there and that if we only had better ways of measuring it, all this "potentiality" stuff would disappear and we could return to the ordered, knowable, Newtonian universe. Einstein's famous quote, that "God does not play dice" expressed this sentiment.

However, the hope that this would ultimately be resolved as a problem of measurement error has been dashed by the experimental evidence [1.2]. More than three quarters of a century have elapsed and the accuracy of this equation has been demonstrated by repeated, rigorous experimental evidence and by a proliferation of technological innovations based on quantum mechanics. Hard as it is to grasp, *multiple potentiality is inherent in the nature of reality*. There is no "objective reality" independent of measurement. What this implies is that the method of measurement is extremely important for the outcome. If we set up the light experiment to measure particles, we will see only particles. If we set it up to measure wave forms, light will appear as wave forms, but not particles. This has important implications for research and particularly basic biomedical research, which is primarily designed to see particles (receptors, DNA base pair sequences, etc.). Given the dual nature of reality, it is important to ask whether or not setting up experiments so that we only see particulate aspects of matter is obscuring other important information that could improve clinical outcomes.

The profound implications of quantum mechanics have been extensively discussed by physicists for many years. One prominent physicist, Hans-Peter Durr [1.3], retired Director of the Werner Heisenberg Max Plank Institute in Germany and co-author of a number of papers with Werner Heisenberg, says that, "Einstein's special theory of relativity, however, enforced another important change by revealing mass as a special form of concentrated energy. As a consequence there is no principal difference between matter and force field anymore..." This statement actually makes energy the primary substance which then "congeals" into matter (see also Heisenberg, above). So rather than matter being the most fundamental substance, as is believed in biomedical research, energy is depicted as the primary focus. Durr says that the wave/particle duality "forced physics out of its old setting as a reality of interacting objects, into a new setting of mere "potentiality" which, under special conditions is capable of coagulating into reality." At the moment of measurement, the multiple possibilities disappear and potentiality becomes reality. Durr draws the conclusion that to the extent that we can measure individual particles, they are excerpted from a context or "whole." Thus, he also turns the tables on reductionism by implying that accurate knowledge of the particle can only be achieved by first understanding the larger context from which it was extracted. What comes first is a state of multiple potentiality. Only by understanding the context of this multiplicity, can we hope to understand the role of the singularity that has been extracted. If we return to our first example of how a building reacts in strong wind, we will not understand the role of the screw until we have seen the blueprint and know how the screw fits into the context of the design. If the screw is appropriate for the design but the design is not appropriate for the geographical region, then examining the screws will not help us.

As the quotes from both Durr and Heisenberg demonstrate, the important implication of quantum physics is that materialism, i.e., the theory that all phenomena in the universe, including mind, have their causality in matter, is not an accurate depiction of reality. Either there is one fundamental substance that can assume the form of either energy or matter, depending on how it is measured, or, as Heisenberg stated, "the basic substance 'energy' becomes 'matter' by assuming the form of an elementary particle" [1.1]. This has profound implications for biology and medical science, both of which assume the opposite, namely that matter is primary. This (incorrect) assumption leads biomedical scientists to automatically assume that the different forms of energy measured in and around the body (e.g., heart rhythms, brain waves, and electrical properties associated with skin conductance and muscle tension) result from or are artifacts of matter, and do not play a causal role in either organ functioning or the disease process. This assumption is so universal in medical research that it has assumed the form of an axiom which no one has actually bothered to verify experimentally. Because physics is not a part of most medical and graduate school curricula, the implications of quantum theory for biology and medicine have been lost. Materialism is still the doctrine that dominates scientific thinking in these fields and dictates the definition of what constitutes plausible mechanisms and good science. Science is not as objective in its methodology as it would have us believe.

The extent to which the materialist belief system influences scientific investigation can be illustrated by an experiment that took place several years ago. A study was conducted in which all patients entering a coronary care unit at San Francisco General Hospital for a period of ten months were randomized to either a treatment or a control group [1.4]. Although the nature of the study was explained to the patients, both they and their doctors were blinded as to which patients were in the experimental group. Both groups received standard care. In addition, the experimental group received intercessory prayer. Each patient was assigned to several intercessors who were asked to pray daily during the patient's hospital stay for a rapid recovery and for prevention of complications and death. They never met the patient. The intercessors were "born again" Christians, who were given the patients' first name, diagnosis, and regular progress reports. They were free to add anything else into the prayers that they chose. The praying was done outside the hospital. Statistical analyses showed no differences in severity of illness between patient groups at the time of entry into the study. By the end of the study, the group that was prayed for had experienced fewer incidents of cardiopulmonary arrest and pneumonia, had taken fewer diuretics and antibiotics, and had required fewer numbers of intubation/ventilation procedures than the control group. These results cannot be written off as placebo because the patients did not know who was being prayed for and who wasn't. Nor can they be attributed to social support, because there was no interaction of any kind between patients and those who prayed for them. If the results cannot be attributed to a placebo effect or to social support, both of which would have been worth investigating in their own right, what then? The results of this study violate two of the most fundamental assumptions of biomedical science: 1) any cure for physical illness must be found in matter (prayer doesn't fall into this category and couldn't possibly have an effect); and 2) God does not exist, and therefore praying to God couldn't possible work. The results of this study imply (but do not prove) violations to both of these doctrines – there might be a God involved and there might be an energy source involved in the healthier outcome of the prayed for group.

The results of this study were initially ignored. Then there was a follow-up study, also of coronary patients [1.5] that further supported the beneficial effects of intercessory prayer. That study, published in a more prestigious journal, was followed by a backlash of commentary and an article [1.6] declaring that, "no effect of intercessory prayer has been proven". A subsequent trial [1.7] that did not give the intercessors any feedback on the progress of the patient being prayed for, found no significant improvement in prayed for patients. An additional trial [1.8], randomly assigned the cardiac patients to three Christian sites that had agreed to pray for the patients for 14 days each. The agreement was that the daily prayer assignment would be covered by someone at the site. No feedback was given on patient progress and the fact that the lists could theoretically be prayed for by different people every day, lessened the probability that the prayer would feel connected to the prayed for person. This study also failed to show any improvement in patients who received prayer over those who did not [1.9]. A review of the literature on intercessory prayer in general stated that "although some of the results of individual studies suggest a positive effect of intercessory prayer, the majority do not and the evidence does not support a recommendation either in favour or against ..."[1.10].

The reason that feedback about the patient may be important for intercessory prayer has to do with the energy associated with prayer. When we pray for a loved one, we pray with love, emotion and intensity. When a stranger is being prayed for, progress reports help the intercessor feel connected to the person and to the results of the prayer. If progress is good, the intercessor may continue to pray in the same manner. If the patient's condition worsens, the prayer may be intensified, made more specific or changed in some other way. Why does this matter? Since the measurement of brain waves essentially involves measurement of energy fields on the surface of the scalp, it is not illogical to assume that thoughts have energy. In fact we can measure electrical potentials that are evoked by the brain's reaction to certain stimuli. So why would thoughts involved with prayer not also have energy? If these thoughts (prayers) involve a force field, then the possibility exists that they could influence other force fields (e.g., heart wave frequencies). The mechanism of influence (movement of the field through space/time, non-locality, etc.) is yet to be elucidated. However, these questions are not as strange as they seem and will be explored more fully in the section on the physics / biology interface. What the example illustrates is the way that medical science is influenced by its belief systems. In this case, the procedure of the successful intercessory prayer study was ignored by researchers who did not understand or believe that it mattered. When new trials using different methodology failed, the assumption was that intercessory prayer didn't work.

Any discussion of matter as it relates to the nature of reality would be remiss if it did not include a discussion of current theories concerning human evolution. Since Darwin's theory of evolution is currently the dominant theory in biology, and since it was derived during the period when materialism was consistent with theories of physics, this is a good place to examine its tenets.

1.2. DARWINIAN EVOLUTION

> "…history will ultimately judge neo-Darwinism as a minor twentieth-century religious sect within the sprawling religious persuasion of Anglo-Saxon biology."
>
> —Lynn Margulis, Distinguished Professor of Botany [1.11]