HUMANITY IN A CREATIVE UNIVERSE

STUART KAUFFMAN

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To Elizabeth Kauffman, In Memoriam, Katherine P. Kauffman, Ethan Kauffman, John Beebe.

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Stuart Kauffman
Crane Island, Puget Sound
July 10, 2015

Prologue

RECLAIMING ENCHANTMENT

Science alone will paint no metaphor of the face of God.

ALAN BEEM, age 26

THE OVERARCHING AIM of this book is civilizational, far beyond the science and philosophy about which I write. Human culture and the ways we humans are in the world have evolved profoundly since we were hunter-gatherers and Cro Magnon painted aurochs on the cave walls of Southern France and Northern Spain and then followed the great herds north as the last Ice Age receded. With agriculture, the accumulation of wealth became possible, and the great early civilizations of Egypt, Mesopotamia, and China arose. With the accumulation of wealth arose vast differences in wealth and power for the first time in human history. Cuneiform writing was invented in the West at about that time, as were other forms. But it is the Axial Age, more than a thousand years later, that must rivet us. In the middle of the first millennium B.C.E., across much of the world, what we now call our "classics" arose, and with them a new phase in the becoming of culture and human mind: the Hebrew prophets, Amos, Isaiah, and Jeremiah; the texts of Plato and Aristotle; the Analects of Confucius; the Daodejing; the Bhagavad-Gita; and the teachings of the Buddha in the Pali Canon. The "Axial Age" was named by Karl Jaspers shortly after World War II, who described this period as a fulcrum, an Axis, around which, across much of the globe, our sense of ourselves changed. In brief, early "religions" were about our welfare, good hunting, and good weather, appeasing and praying to local gods for intervention. With the Axial Age, for the first time, humans began to seek something "higher," the ethical for Confucius, the Dao, Buddha and Enlightenment, and Plato: We seek the Good, the True, and the Beautiful. Plato, in the allegory of the cave, never defines "The Good." It is as the sun, seen when we turn from facing the shadows cast on the cave wall, to look at it, but staring can blind us.

In diverse ways, sum Bellah, Joas, and other contributors to this book (Bellah and Joas 2012), humans sought transcendence, thus seeing themselves beyond the "human self and group welfare" of early religions.

In the West, this became the Hebraic-Hellenic roots of our common civilization. The Greeks sought universals, the ancient Jews the specificity of their lives with their God and history.

How we see the world profoundly shapes how we see ourselves, and with it, what we are and become. The Ancient world of Greco-Roman thought transformed at least with Constantine to Christianity in the West and eight or so centuries of the Church's view of God and Man and our humanity. The discovery of an intact text of *De Rerum Natura* by Lucretius in the 1300s unleashed a rediscovery of the Greco-Roman world and within a century, the Renaissance, surging beyond the Church's view of our humanity to give forth Da Vinci's *Mona Lisa* and Michelangelo's *David*. With these, came a soaring of our individual humanity. Two centuries later in the West, Descartes unleashed the scientific objective world view, culminating somewhat more than a century later with Newton and the creation of classical physics. Weber has written that with Newton we became disenchanted and entered "modernity." He was right, from Newton to the Enlightenment, the Age of Reason, where all could be, in principle, known and mastered, mystery gone, to the Industrial Revolution, to "modernity" and the diversities of "postmodernity."

The transcendence of the Axial Age is largely lost in the struggle between the two Magesteria of Stephen Jay Gould, religion and science. Science has largely won. Our spirituality is submerged.

To borrow the superb phrase of Thomas Cahill, historian, we are at a "hinge of history." Our thirty or more civilizations across the globe are weaving together, in part driven by globalization of commerce and of communication. For the first time in history we have the technological means to assure an adequate standard of living for all, or most of us, despite grotesque inequality in current wealth distribution. We live on a finite planet we despoil in the name of forever economic growth. Yet we hunger, and read the Romantic poets seeking re-enchantment. In addition to Keats, try Dylan Thomas if you have not tasted.

Are we poised, as some of the authors in Bellah and Joas's book argue, for a new Axial Age? If at a "hinge of history," what will we become? Can we see ourselves anew in the world? And as a consequence become anew?

The fullness of our human lives in a creative universe and the woven civilizations across the globe that we co-create is therefore the central issue

of this book. With this, I hope to be at least one voice that may unleash an unprestatable becoming of a new Axial Age. I hope to be at least one voice that may help unleash us where we are fettered by lingering good science that blinkers us, from Newton to Darwin to Adam Smith, to John Locke, superb all, whose work laid the foundations of modernity and postmodernity in its diverse guises and sequelae, and whose work constitutes what I will call the "mythic structure" of modernity. I believe we need a new mythic framework. The aim of this book is to seek such a new mythic framework that can guide us, even as we co-create what we cannot prestate and then flow into the very Adjacent Possibilities we helped to make.

We "become." We have not known that we become into the very possibilities we unknowingly create, beyond what can be known even to be possible, as thought in the Enlightenment, the Age of Reason, where all could, in principle, be known and mastered. No, the world is not so.

If we ask: "Does whatever modernity or postmodernity may be serve our humanity?" Even with current democracy where it flourishes, and whatever the material abundance we have achieved, if grossly maldistributed, I believe many of us think the answer is "No." As Gordon Brown, then Prime Minister of the United Kingdom, said in a speech in Strasbourg, "We are reduced to price tags."

The central aim of this book is truly civilizational. My hope is that we rethink ourselves and our world and feel invited to co-create and evolve toward a new interwoven civilization beyond our own.

We will not rush to do so: the hold of the present is far too great. But if we think together and see ourselves and reality differently, we may come to be in the world in a different way.

Our current "mythic structure" derives from physics, biology, and economics: Newton, Darwin, Smith and Locke. I borrow in part from Andreas Weber, who thinks in terms of "enlivenment." With Newton, we adopted the objective view of the world, to be known and mastered. That world of classical physics is entirely entailed. Nothing emergent, not entailed, can arise. Magic is gone. Worse, we literally "lost our minds," our subjective pole, the legitimacy of our conscious experience and free will. Without these, we are not human. We also lost the central sense of ourselves as alive in a living biosphere, which we are *of*, not above. Nature is not ours to wrest our due.

From Newton we achieved and are now trapped by the view that there is a "theory of everything," reductive materialism, whose laws will "govern" and logically "entail" all that can or does become since the Big Bang, but are themselves somehow "outside of the universe." This is the Pythagorean dream of a

mathematizable world. I aim to show that this view is surely false for the living world and perhaps aspects of the abiotic world. But with Newton we have come to believe we live in a world that is knowable, hence "solvable." We can optimize, find the best solution, but typically do so only to prestated problems and opportunities. Driven by this faith, technology and scientism overwhelm us. This is not real life for the evolution of the biosphere, our economy, culture, and history, where we often cannot know and cannot even prestate the opportunities and harms for becoming that will arise. Not only do we not know what *will* happen, we often do not even know what *can* happen. If we cannot prestate what *can* happen, we cannot know what can happen and thus cannot reason about it. But we must live forward anyway, and reason, the highest human virtue of our beloved Enlightenment, the Age of Reason, *partially* fails us. We become, partially beyond knowing. We, life in general, and perhaps aspects of the abiotic universe, flow into the very possibilities our status nascendi becoming creates. We "become" into an "Adjacent Possible," are "sucked into" the very possibilities we, often unknowingly, ourselves create.

Weber and Larry Arnhart rightly point beyond Newton to two of the other giants of science who shaped us and modernity and its mythic structure: Darwin and Smith. Darwin gives us evolution via natural selection, the appearance of design without a designer, hence the possibility that society can self-organize from within, not requiring an outside authority such as God for its structure. But Darwin's selection was initially too narrowly understood as "survival of the fittest," suggesting natural selection acting only at the level of the individual and its progeny, hence a competitive race. Then a kind of evolutionary "selfishness," the selection of the fitter individual with more progeny, selfishly organized the biosphere. Smith gives us the selfish individual and the "Invisible hand" where the selfish interests of the shoemaker and candlestick maker, each acting only for herself, benefit all. In this framework is the rise of modern liberalism, the view that rationality and self-organization, well framed by reason, will lead to a well-wrought society from within. The same views lead to capitalism.

We are children of the political ideals of the Enlightenment, including Locke, friend of Newton, from whom we got the idea of government as a balance of forces, in the United States, the executive branch, legislative branch, and judicial branch as mutual counterweights. We wanted no king ruling by Divine Right. Locke gives us the idea of personal liberty and property ownership, essential to Smith's invisible hand. "Life, liberty, and the pursuit of happiness," wrote Jefferson. Yes, with Locke we achieved the ideal of a republic that balances equality with our drive for power, seen in many civilizations

since the agricultural revolution allowed the accumulation of massive stored wealth in the first civilizations in Mesopotamia and Egypt.

With Newton, Smith, and Darwin, Locke gives us our political framework, the fourth part of our mythic structure.

This book has three parts. The first part shows that the becoming of life, and perhaps even aspects of the abiotic universe, are beyond foundational entailing "laws," the Pythagorean dream, the dream of the "theory of everything," reductive materialism, of enormous success, and revered, but whose hegemony I seek to demolish. I hope to show you that the becoming of the biosphere is beyond law. If so, reductive materialism as a whole must fail, for the biosphere, lawless, is part of the universe and cannot be governed by a final theory. Furthermore, the becoming of the biosphere is more mysterious than we have thought, for it demonstrably creates the very possibilities into which it becomes, and it does so without selection's "acting" to achieve those possibilities. Furthermore, we must think, and explain in ways Newton did not teach us, for we cannot deduce and test from the missing laws that what we predict will happen. Not everything that is real, such as giraffes, can be predicted or known ahead of time. We really cannot always *know* even what *can* happen. Part I shows us that the becoming of life, of civilization, perhaps, even aspects of the universe, may be beyond foundational governing law and beyond knowing ahead of time. We are free to become in ways we do not yet know, but always as enabled by constraints that do not cause, but enable what, often unprestatably, next can become, status nascendi. This becoming is radically emergent. We are of it. Max Weber did say that with Newton we became disenchanted and entered modernity. Here is emergent magic to re-enchant us.

We have lost the subjective pole, our consciousness and free will able to act upon the world, to Newton and objective third-person science, and with that loss, lost our humanity. Part II is an attempt to regain that subjective pole. It is a long and speculative, partially testable, discussion based on quantum mechanics. Very recent and very tentative evidence supports aspects of the view I will discuss. It leads toward a vastly co-creative universe in which Mind, conscious and free willed, participates in how and what the actual universe becomes from electrons to us. What I shall propose is not unique: Roger Penrose in *The Emperor's New Mind* and *Shadows of the Mind* (1989, 1994) precedes me with rather similar ideas. Both Penrose and I lead us to a possible panpsychism, a pattern of ideas going back at least to Spinoza, Leibnitz, William James, C. S. Peirce, and others. Those earlier ideas were based on the seventeenth-century conception of matter and mind, trying

to unite them. Quantum mechanics supersedes the seventeenth-century concept of matter in classical physics. With it, free will and mind become possible.

Part III hopes to build upon the freedom from Part I and hopes for our subjective pole from Part II. The central issue is what we may want? What might a new mythic structure be that can further guide us as we co-create what we cannot prestate? I discuss recent work on the origin of life, hence "what is life?," Erwin Schrodinger's famous question in his book of the same name, that helped found molecular biology. Our questions here have been limited to classical physics and chemistry. But quantum mechanics may play unexpected roles, as I will discuss. Given life and mind, how do we humans live it? And in the final chapter I brave the issues: Where are we? How did we get here? What might our new mythic structure contain that is beyond our current mythic structure? As a consequence, quo vadis, and how, when we cannot design but must grow, ever partially unknowing, what we become.

Among the themes of that new mythic structure beyond that of modernity are the following:

1. Beyond Newton and the entailing laws of physics to the emergent historical lawless becomings of life, culture, history, and perhaps aspects of the universe.
2. Beyond Smith and Darwin as support for selfishness as the best or dominant driving force in the self-organization of society. Ecosystems of mixed microbial species collaborate functionally in rich, but largely unknown ways, to flourish. So do we.
3. Beyond overreliance on reason. We live into the future not even knowing what can happen and have for thousands of years. Doing so is part of our human creativity. This creativity is ours, part of us in a creative universe, part of what must be in our mythos.
4. Centering on our emotional, phenomenological aliveness as individuals and in our social structures, where our emotions are the dominant source of motivations, and biologically and culturally evolved values, and the pursuit of happiness of which Jefferson wrote. But also the same evolved and cultural emotional values can play their role leading to hegemony, power structures, and violent fundamentalisms.
5. We rape the planet in the name of forever growth of gross national profit; we need an economic and cultural notion of "enough." Without it, given that rape, enough is enough.

6. Spirituality as central to our lives and fulfillment, from shaman, to gods, to *Re-ligio*—re-tie—with whatever faiths, to creative nature as sacred, but somehow without violence.
7. Our rapprochement with Nature, no longer ours to wrest our due, we are *of* Nature on a planet that should not be raped. Estranged from Nature? No.
8. An ever-clearer understanding of how wisely to garden the Adjacent Possibles, the opportunities we unwittingly co-create and into which we rush, are "sucked" but often cannot prestate, with possible new forms of governance beyond Locke.
9. We are creative in a creative universe, much of life and the universe is a status nascendi, a becoming. This is the center of our new view of ourselves and reality.

What will we make of all this? We cannot prestate, but our humanity is at stake.

1

Hinge of History

THE TRUE AIM of this book is civilizational. Indeed, *we* are the aim of this book. So much lies before us. We so wrongly think we know our worlds. We so wrongly believe that we can pose and answer our questions, when we often cannot even pose them adequately. We know intuitively that the becoming of our human lives, cultures, and economies is open and creative in ways not heeded by contemporary science. Yet science is our new reigning "god," derivative of Francis Bacon: "I take all knowledge to be my province. To put Nature on the rack and wrest our due." Wrest from Nature we have; lost from Nature we largely are. We know we despoil our home planet, but like the Venetians who cut down and denuded the nearby forests of the Dalmatian coast to build their ships, we wrest and wrest in the name of forever growth of "gross domestic product" on a finite planet.

And so much is wrong. In the United States, my home, power structures strangle us: banks too big to fail are bigger, fewer, and more consolidated than during the 2008 financial crash they largely caused. The financial industry is a larger fraction of the United States, and most of the First-World economy, than at any other time in history. We need capital formation, but we do not need what we now have that endangers us and robs us. In the United States, Congress, often responsible for our predicament, is controlled by lobbyists, who are often chosen from those no longer in Congress but with rich political contacts—a clear conflict of public interest. At a minimum we need to know how power structures form and how they evolve and adapt. I will try to present a new framework to think about this in later chapters, for we are not helpless. The aim is not to destroy dangerous power structures but, for the benefit of all, to help transform them.

A close friend of mine once said that if poetry is not at the center of a civilization, something is deeply amiss. Where is art in our modern world?

Perhaps it remains best seen in cinema in our wider culture. But poetry, art, music, even plays, are less among us, enamored as we are of Walmart. Poetry is metaphor, neither true nor false, but rich and evocative of our wider selves.

Facts and true statements are wonderful, rich, and enabling but also too much with us. Michelangelo's *David* is not a "fact" true or false; it is "us." Propositions and logic are wonderful and richly enabling of much of language, mathematics, and the life and technology we have created in part with it, at the price of categorizing the world. But the world is and becomes, beyond our categorizations, often beyond "scientific law," I hope to show, and we are of this creative world, beyond "sciencia." "Would you rather be Einstein or Shakespeare?" I asked myself, when I was younger. Einstein, of course. But that is not my answer now, magnificent as he was. It is Shakespeare who taught us what it is to be human. "Everyman" is more than science.

Arnold Toynbee in *A Study of History* (1934–1961) famously argued that civilizations are born, mature, and ultimately die. Typically, he argued, a spiritual rebirth in the dying age of a civilization lays the foundation for the new, unexpected, unprestatable civilization that emerges. He may overstate his case, but the rise of Christianity in the late Roman Empire bespoke a thousand years of a new church view of our humanity, a view of our humanity transformed by the Renaissance's rediscovery of antiquity unleashed by finding a full manuscript in the monastery of Fulda, of *De Rerum Natura* by Lucretius. In the Prologue, I spoke of the "mythic structure" of First-World modernity and its sequelae, derived from Newton, Darwin, Adam Smith, and Locke. *De Rerum Natura* unleashed Florence, Michelangelo, da Vinci, the Medici, and the Renaissance—an entire new view of our humanity.

And now? The Renaissance became the Enlightenment, the Industrial Revolution, modernity, and then postmodernity. Newton's laws, as we shall see, entail the becoming of the classical world, and we are mindless machines in it. Darwin gives us descent with modification and natural selection, the appearance of design without a designer, via "survival of the fittest," too easily translated into mere selfish competition, nature red in tooth and claw. Darwin, monumentally, gives us in Western science *history*; Smith gives us selfish individuals, human only in preferences and trade decisions. With Locke as well, modernity is built upon these conceptual foundations, our "mythic structure."

I have spoken to a modest number of people; we all sense something deeply deficient in our modern civilization. Is it an absence of spirituality? Partly. A greedy materialism beyond what we really need? Yes, we are riding the tiger of late capitalism, where we make our living producing, selling, and buying goods and services we often do not need on this finite planet. We are hanging onto the tail of this tiger, in a sense not knowing what else to do. "Purple plastic penguins for the poolside?" Well, I want no culture czar telling me "No." But do we truly need much of what we make and sell? No, probably not. What else might we do? What about art, poetry, adventure, joy, laughter, silliness, honor, integrity, love? What about just being ourselves flowering? But then, what is it for *us to flower*? What, then, is our humanity? We cannot see ourselves, in part blinkered by unneeded "scientism," technology and the blinding lights of apps, and ads, including those for medicines where the dangerous side effects are quietly spoken under cover of soft romantic music. Sell or die. Why? Why so excessively? Tail of the tiger, that's why. But then, Why?

We have forgotten that we are, first of all, alive, and alive in a becoming biosphere, a rich and almost unfathomable becoming, as we shall see, in ways we cannot prestate, yet is somehow coherent. Despite bursts of extinction events and the fact that 99 percent of all species are gone, the biosphere flowers on. And on and on and on, ever-becoming beyond what we can say ahead of time.

This flowering of the biosphere, more than a metaphor for human history, begins to suggest a mythic structure beyond that we live by. We need no longer choose to do so, and we can find a new mythic structure for our transformation.

We can, for the first time in history, afford a wider civilization where our material needs are largely met. This affords us a unique choice: We can afford to become what we can partly envision and partly co-create, although ever-unknowing of all we will unleash. Thus, our central issues are "What do we hope for, what is our dream, if only partially statable? How do we start?" Andreas Weber, in his *Enlivenment* (Weber 2013), dreams of us individually and together living "fully," where living fully becomes our single and transcultural dream, sustained by the new mythic structure I hope this book contributes to. Fully alive, like the becoming biosphere, it is a confused mess of becoming, collaboration, competition, coherence and its failures, ever-new, ever-unfolding, creative, co-creative, creating the very possibilities into which we almost ineluctably become. This theme of becoming into the ever-new, largely unprestatable, Adjacent Possibles we ourselves persistently create is a main theme of this book.

Part I: Beyond Reductive Materialism

Part I (Chapters 3–5) seeks to state and at least to destroy the hegemony of reductive materialism, the magnificent structure built by Descartes, Kepler, Galileo, Newton, Laplace, Einstein, Bohr, Schrodinger, and others hoping that a final theory governs and hence entails all that can and will become in the universe. But if no law entails or "governs" the becoming of the biosphere, which is part of the universe, reductive materialism must, in broad view, fail: If no law entails the becoming of the biosphere, part of the universe, then *no* law entails the becoming of the entire universe! Weinberg's dream of a final theory must fail (2014). Moreover, I hope to convince you that no law entails or governs the becoming of the economy, or the social cultural world, in part due to the conscious choice afforded by free will, which is discussed in Part II. Part I sets us free. We are not entirely entailed by governing laws. We will find a living world that is a world of unprestatable becomings, a status nascendi, of co-creation beyond our knowing beforehand. Reason will often fail us: not only do we not know what *will* happen, but we often do not know what *can* happen. If not, we cannot reason about what we do not know *can* happen.

We will find a new pattern of explanation for the living world: ever-new Actuals do not cause, but *enable* ever-new, often nonstatable, adjacent-possible opportunities into which we are "sucked." We will find ourselves beyond Newton, Darwin, Adam Smith, and Locke, thus past our First-World mythic structure. We will be forced to change that mythic structure. What a stunning opportunity: we can begin to shape the mythic structure that can guide us beyond whatever late modernity is, into what we can co-create but cannot control or prestate. We become! We are status nascendi, a generalization of improvisational comedy where none in the troupe, us, knows beforehand what we will co-create: we co-create our lives and our evolving woven global civilization.

Further, I will dare to ask if the Pythagorean dream of foundational laws, themselves outside of the universe, is forced upon us. I think not. All may be emergent and ultimately lawless at base. All may be a status nascendi. All may be emergent and without foundation in Pythagorean "law."

All this matters! We are, in fact, at a hinge of history. Our thirty or more civilizations are thrown ever-more into intimate contact, sparking opportunities to co-invent, and rage, as cultures collide. Before us, as never earlier in human history, is what we will make of ourselves and our home planet.

Demolishing the hegemony or even *all* of reductive materialism, I dream, sets us free to, well, dream and create.

Part II: Seeking Our Subjective Pole

Part II spans from Chapters 6 through 14. With Newton and classical physics, we vaulted into third-person objective science, mastered how to get to Mars, but lost our minds. We have become either zombies, and at best have no free will, or if conscious, that consciousness cannot alter the world it merely witnesses. Our consciousness is merely "epiphenomenal," with no effect on the world. Then why did our complex brains evolve?

We will never get beyond this, trapped here since Descartes' res cogitans and res extensa led via Newton to the death of res cogitans and the triumph of res extensa, thus classical physics up to general relativity. The stalemate yielding at best a witnessing, epiphenomenal consciousness and no free will is precisely due to the causal closure of classical physics. To get beyond the stalemate we must go beyond classical physics.

Consider this: Several years ago, NASA chose to design and send a rocket to Mars. The rocket landed on Mars, slightly changing its mass, hence the dynamics of at least the solar system. We all believe, and in the United States, we fund NASA, to make such decisions, design or not such craft, and carry out or not such missions. We believe we have free will to choose, could have, contrary to fact, chosen otherwise, can responsibly act, and in doing so we can change the world, even the solar system. Our legal system assumes the same, as do our political and economic systems, Smith and Locke included. But on classical physics, none of this can be true. A first way to see this is that in classical physics, given initial and boundary conditions and the laws of motion of the system, say billiard balls rolling on a fixed table, only what *actually* happens can have happened. The present could *not* have been different! But free will to choose or not demands that the present *could*, counterfactually, have been different. We are lost if we stay in the classical physics stalemate. But quantum mechanics affords a, or perhaps *the* way forward. In quantum mechanics, the outcome of a quantum "measurement" could have been different, so the present could have been different. This is a minimal ontological requirement for a free will. Only quantum mechanics offers ontological hope for our capacity to choose or not to send a rocket to Mars, altering the dynamics of the solar system. More quantum mechanics points beyond physics, to a role for the observer in what arises.

No one thought that quantum mechanics could matter in the warm wet world of biology. However, in the past number of years it has become clear that this view is wrong. Light-harvesting molecules can be quantum coherent for a thousand times longer than thought, and their quantum behavior is related to the efficiency of converting harvested light to chemical energy in photosynthesis that drives much of life (Engel et al. 2007). Bird migration in the Earth's magnetic field now seems to require quantum effects (Gane et al. 2013). Our best hope for a conscious mind (and free will) that can be part of altering the world, not merely "epiphenomenally" witnessing it, lies in quantum mechanics. We've lost our humanity to amazing Newton and objective science. Quantum mechanics can give us back our subjective pole, hence our richly evolved humanity.

Part II is, therefore, a long discussion of quantum mechanics. I discuss a new "state of matter" hovering reversibly between quantum coherent and "classical behavior," the Poised Realm, patent issued and issuing (Kauffman et al. 2014). The Poised Realm breaks the causal closure of classical physics and allows quantum and poised realm mind to have *acausal* consequences for the "meat" of the brain and body. Mind and brain and body and we together can act in the world with free will. The same ideas lead to trans-Turing systems that are quantum, Poised Realm and classical, and *not* Turing machine algorithmic. Our minds need not be algorithmic or merely epiphenomenal. However, no third-person description can yield us consciousness, as David Chalmers argues (Chalmers 1996).

To go further, I offer a new interpretation of quantum mechanics and a new analysis of what is called the quantum enigma (Rosenblum and Kuttner 1996). I am not a physicist, so be very skeptical. One of the central ideas I broach, almost demanded by quantum-coherent behavior which fails to obey Aristotle's law of the excluded middle, is that quantum-coherent behavior cannot be about Actuals that do obey that law, but it can be about ontologically *real possibles*, which do not obey the law of the excluded middle. I will propose res potentia and res extensa linked by measurement. This naming is in honor of Descartes. But Descartes offered us a failed substance dualism, res cogitans, like res extensa is "stuff." Res potentia is not "stuff" because possibles are not "stuff." My dualism is new—not prey to the devastating critiques against any substance dualism. On this view the world consists of at least a dualism, Possibles and Actuals. The postulate of ontologically real Possibles, res potentia, is in none of the other perhaps fourteen interpretations of quantum mechanics. More the postulate of ontologically real Possibles, res potentia, answers at least four deep and unexplained mysteries of quantum

mechanics. First among these is the enormous mystery of "nonlocality." Here two widely separated but "quantum entangled" particles have the property that measurement of the first *instantaneously* alters the outcome of the later measurement of the second, even though no light can travel between the two locations of measurement in the time interval between measurements. Because light is the maximum but finite velocity of any causal effects, the instantaneous correlation of the two entangled measurements cannot be due to causal effects. This radical prediction, first made by Einstein, Podolsky, and Rosen in 1935 to show that quantum mechanics must be incomplete with "spooky action at a distance" has now been very well confirmed experimentally. The world, like it or not, has effects, called "nonlocal" that cannot be causal. As I will show, the postulate of ontologically real possibles seems to explain nonlocality easily. No other explanation for nonlocality seems to be at hand or accepted. Ontologically real possibilities can explain three other mysteries, as I will discuss in Part II.

But none of this gets us to consciousness or free will. Quantum mechanics and the quantum enigma (Rosenblum and Kuttner 1996) seem to afford an avenue. Bohr (1948), in the Copenhagen interpretation of quantum mechanics, and von Neumann in his 1933 masterful mathematical treatment of quantum mechanics and quantum measurement, both thought that human conscious observation could mediate measurement. Very recently, very tentative experimental evidence by Dean Radin (2012, 2013) suggests that human conscious attention, even at a distance, can alter measurement. We are not to believe Radin's results as yet. But they point one way to demonstrate that human conscious attention can alter the outcome of quantum measurement.

Further, the quantum enigma demands much the same and more. The enigma states, roughly, that we can ask a question of nature, but we could have asked a different question of nature; that is, we could do one experiment but could, free-willed, have chosen, counterfactually, to have done another experiment. Then Nature answers, and the answer *depends upon the question we free-willed chose to ask*. Jointly, we and Nature *create* Reality. Are you shocked? But we sent a rocket to Mars, and did so, we think, consciously and free-willed, but we could have done otherwise and altered the dynamics of the solar system.

To solve the enigma, I will propose that we are conscious and so are quantum variables such as electrons and protons exchanging photons measuring one another, where measurement is mediated, I claim, by consciously observing one another. I cannot see any way of showing that electrons consciously measure one other, but Radin's experiments are a first hint that we can show

how human consciousness can "mediate" measurement, perhaps even nonlocally. And there are other experimental approaches to show the same thing. If this be true, after much evidence, then, as we shall see, physicists claim that classical recording devices can mediate measurement. But then we either have to "invent" another means for classical devices to mediate measurement, or we try the idea that at base, "classical" devices are quantum and the quantum variables consciously measure one another.

This all leads to a vast panpsychism, in which all quantum measurement is mediated by Mind, conscious and free-willed, as part of the furniture of the entire universe! It is the enigma all the way down. Mind is part of the actual becoming of the universe, we altering the mass of Mars, down to any quantum measurement and its Actual outcome! Each such measurement alters what the world becomes. If so, if measurement is mind measuring consciously and with free will, bounded by what is called the Born rule, then the entire becoming of the universe is *not entailed*. We are profoundly free! I will expand my dualism, res potentia and res extensa linked by measurement to be measurement acausally by conscious, free-willed *mind*. I am led to a new triad: Actuals, Possibles, and Mind. Mind measures Possibles to yield, acausally, new in the universe Actuals, which acausally yield new Possibles for Mind to measure to again yield new Actuals yielding new Possibles for Mind, with free-will, to measure. All is a becoming, nothing *is*, and all is an unentailed status nascendi, entailed in detail by nothing. Penrose's view (1989, 1994) is a cousin of these ideas.

Yes, Shakespeare: "Horatio, the World is richer than all your philosophies." But pause: The Triad, like all interpretations of quantum mechanics, is insufficient. Whence the "classical world"? We get to Mars using Newton's classical physics laws, and gravitational lensing according to classical physics general relativity is well established. There are diverse tries at getting from the quantum to classical world. I shall offer a new and testable proposal based on what is called the quantum Zeno effect, just a hope at present. The mind-body problem requires a body. Moreover, evolution could not have happened without a "stable-enough" classical world in which adaptations could have accumulated. We must have a classical-enough world as well as something like the Triad, or the different attempt of Orch Or by Penrose and Hameroff (Penrose 1989, 1994) that also yields a consciousness and probably free will as part of the universe, hence mind and a panpsychism similar to the Triad. In the meantime, efforts to unite quantum mechanics with general relativity have failed since 1927. We may find a way, or we may be lost in the wrong

forest trying to do so. I suspect the wrong forest, but I am not a physicist. Just maybe we can get a classical-enough world from the quantum Zeno effect and need not quantize gravity, a claim that is at best a hope, and must infuriate all physicists seeking a unified theory quantizing gravity that will entail all that becomes in the universe, including the unentailed evolution of the biosphere and legal proceedings, where I might or might not be found guilty and hung.

Part III: Regaining Our Fully Alive Humanity

Parts I and II hope to have set us free and have found at least one route, perhaps with Penrose (1989), who includes his work with Hameroff in Penrose (1994), in parallel, to our Subjective Pole with consciousness and sometimes responsible free will. But if these belong to quantum variables (or space-time itself in Penrose and Hammeroff), Mind is surely far different in life and humans. Consciousness and Will have evolved at the origin and with *life*. We are alive first. I discuss recent work that may be closing in on one or more ways life may have originated, perhaps conscious and free-willed from the outset, here and perhaps widely in the universe. We may succeed soon in creating life anew, classical or quantum, Poised Realm and classical. Mind and its living embodiment have evolved on Earth for 3.7 billion years. What is it like to be a bat? wrote Thomas Nagel (1974). Indeed, but what is it "like" to be *Escherichia coli*, the single-celled Stentor that gives signs of emotions ranging from fear to disgust and anger, hydra, a tree, whale, chimp, or us? What is the evolution of our phenomenology and its relation to our embodiment? With mind and body, with our sense of "self" alone and with others, with emotions, cognitions, intuitions, and sensations? What is it to be alive, human, and co-create our worlds? How do we live forward and choose when we often cannot know even what *can* happen? Most centrally, we are largely free, enabling by our laws and culture but not knowing the adjacent-possible opportunities that we co-create. How and for what will we dare and deign to choose and act? We can, for the first time in this hinge of history when our thirty or more civilizations weave together, afford a sustainable life for all. But what will guide us as we choose, not knowing the consequences of our choices? By the very creativity of the universe and we in it, we cannot *know* what we will co-create. Then what can guide us?

Our guide can be a new founding mythic structure that reflects our full enlivenment (Weber 2013), humanity in a creative universe, biosphere and human individual and social lives that are fully lived and keep becoming. The

dream is diversity, more ways of being human as our thirty or so civilizations across the globe weave together gently enough to honor their roots and allow change to unfold gracefully. Horatio, as ever, our global woven civilization is ours to create, ever-unknowing, facing, as Kant said, the crooked timber of our humanity.

2

The Foundations

THE EMERGENCE OF REDUCTIVE MATERIALISM AND THE LOSS OF OUR HUMANITY

MY PRIMARY GOAL in this second chapter is to lay out the overwhelming scientific framework of reductive materialism, which bespeaks most of our scientific view of the world. If we have to pick a singular figure as its dominant author, that figure is Newton. The early sociologist, Max Weber, wrote, as I noted earlier, "With Newton we became disenchanted and entered Modernity." Weber was right: classical physics, the Enlightenment with the demand for the rise of science and "down with the clerics," the Industrial Revolution and modernity with its Enlightenment heritage in political philosophy, in part the child of Adam Smith and Darwin, along with Locke, the massive technology from the Industrial Revolution, and an overarching "scientism." We remain disenchanted in many ways, and we live in a modernity or a postmodernity—whatever exactly we may mean by "modernity"—that serves us well yet does us a profound disservice. I have been a scientist for over fifty years. I love science and admire the vast achievements of modern science, conceptually, mathematically, experimentally, and technologically. But a main point of this book is that science is too much with us, our humanity vastly outstrips science, and it is our humanity and a potential transformation to a civilization that unleashes and serves that humanity as it ever becomes in ever novelty that must be our foremost purpose.

I do not seek to destroy the magnificent house that Newton built, but to end its dominating hegemony over our view of reality. After all, we can and still do get to Saturn in rockets using Newton's laws, and quantum mechanics is validated to eleven decimal places. Modern science is superb. But modern science dominates us beyond what we need.

Furthermore, modern science asserts, assumes, and demands the Pythagorean dream that there *must* be foundational laws, currently general relativity and quantum mechanics, whose laws stand "outside the universe," for in the Pythagorean dream, we may not ask, *Why these laws*? The laws just *are*. Part of what I hope to do in this book is to show us that we are not forced to adopt the Pythagorean dream, which in turn gave rise to reductive materialism. We may be foundationless and ultimately in a co-creative universe. But that radical and highly speculative view is for later. First we need to see our assumed foundations and how we got here.

I begin briefly with Aristotle and science in ancient Greece. Largely this science was not experimental. Thus, for Aristotle, it was clear that moving objects came to rest because absence of motion was natural, that they remained on the surface of the Earth because they sought a natural resting place at the center of the Earth, and that planets in known motion against the fixed stars would follow circular orbits because circles were the most perfect form. I overstate my case. Archimedes' cry, "Eureka," when he understood why some objects floated when the water they displaced was more than the weight of the object, was clearly a mixture of empirical and imaginative, creative science Einstein could have well adored. Indeed, Newton's first law was formulated by a Hellenic physicist about 150 A.D. and Lucretius' *De Rerum Natura*, whose rediscovery helped unleash the Renaissance, invented the "swerve" by moving particles to avoid the utter determinism of Democritus and his atomism, atoms (uncutables) moving in the void and colliding and rebounding deterministically. Lucretius came close to Newton's law of gravity as well: a stone falling through a cylindrical hole through the center of the Earth would not come to rest at the center of the Earth, as Aristotle taught, but oscillate back and forth in damped oscillations until it finally came to rest at the center of the Earth.

I noted earlier that Arnold Toynbee (1934–1961) argues, perhaps too strongly, that civilizations are born, mature, and die. In their death, often or typically there is some form of unexpected spiritual rebirth that forms the seeds of the new civilization. Jesus and Christianity were the seeds as the Hellenic world and Roman Empire failed. With Constantine and the adoption of Christianity by the Roman Empire, for religious and political reasons, the Middle Ages arose, a new civilization, with the Church's view of our humanity that dominated us until the Renaissance began to destroy the Church's view and a new civilization began to arise with a new view of our humanity. This view was captured by Michelangelo's treasures, including *David* and the Sistine Chapel's ceiling, God's finger reaching out and almost,

but not quite, touching the outstretched finger of Adam. How perfect that the two fingers almost but not quite touch. *David*, and God and Adam's fingers nearly touching, evoke; they do not state. Art, unlike science, is not about true and false propositions; it is metaphor, neither true nor false in the sense in which "The cat is on the mat" is true or false and we take science to be true or false. Metaphor evokes. We live richly by metaphor in all our art. Art tells us, Sophocles and Shakespeare, that human aliveness evocable by metaphor is far more than "sciencia," that is, knowing. This too is a major theme of this book. We, alive, are more than we know or can know. With the Renaissance arose a new, unprestatable view of our humanity that ultimately led to modernity via Newton.

One major step in the birth of modernity was the birth of science inspired by Francis Bacon, who argued that we no longer limit ourselves to reading "the philosopher" Aristotle, but look to the book of Nature. Bacon bravely or proudly: "I take all knowledge to be my province" and "To put Nature on the rack and wrest our due!" Genesis, with the reading of Creation, made for humanity's use, not stewardship, echoes in "Wrest our due." Modernity and its overwrought technology skid erratically into the future, as promised by Bacon. We wrest our due and destroy the Earth.

Four other figures dominate the birth of Western science, all well known. Copernicus offered the hypothesis that the planets revolve around the Sun. Kepler, the last of the white magicians, started with the hope that the five planets would follow the five perfect Platonic solids in their orbits but used Tycho Brahe's data to work out that the planets follow elliptical, not circular, orbits around the Earth or Sun. And then Galileo clearly promulgated the view that nature could be described in detail by mathematical laws in his experiments with acceleration of balls rolling down incline planes whose slope "diluted" gravity, and distance covered varies as the square of the time elapsed. And then Descartes. Follow please: Early mathematics before Euclid was largely sums and accounting. With Euclid we get theorems by construction and deduction and even irrational numbers by Pythagoras. The Indians brought us zero and with them negative numbers, and the Islamic civilization brought us algebra, that is, equations such as $y = x - 7$ or $y = x^2$. Given equations with, here, two variables, y and x, Descartes had his famous dream of "analytic geometry" in which all equations would each correspond to some line locus, straight or curved in a Cartesian x, y coordinate system.

In 1640, Descartes set the framework of modern science, with his famous substance dualism, res cogitans, thinking stuff attempting to preserve our "subjective pole," and res extensa, his mechanical worldview, which hoped to