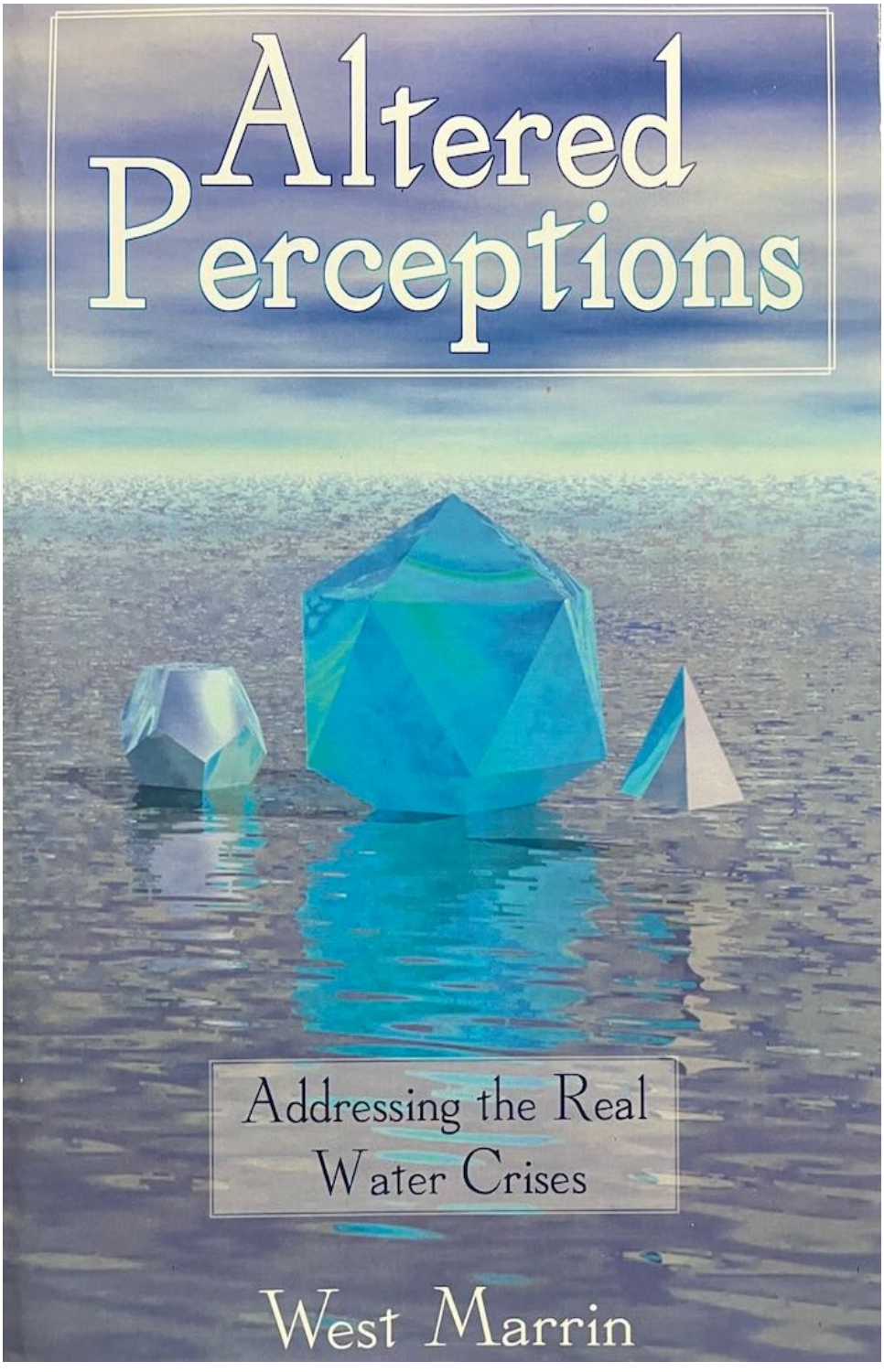
Altered Perceptions



Addressing the Real Water Crises

West Marrin

ALTERED PERCEPTIONS

ADDRESSING THE REAL WATER CRISES

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Unlimited Publishing LLC
Bloomington, Indiana

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Bloomington, Indiana

Dedicated to my father, Doc,
whose perceptions have always intrigued me.

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PREFACE

This book represents my response to several requests made of me over the past three years by associates and readers who either have read my first book or have attended one of my lectures. However, my responses are best understood in the context of observations that I have made in the capacity of a water quality professional and environmental scientist.

I begin with my observations because they essentially set the tone for the book, whereas the various requests dictated specific topics that are addressed in each chapter. The earliest observation of water that I can recall is associated with a lawn sprinkler in our family's back yard and the rainbowlike effect of airborne water breaking the sunlight into its component colors. I was somewhat befuddled at not seeing a similar light show in my plastic cup of water, but I was sure that water must be the "stuff" of magic tricks—requiring only the right kind of props (e.g., sprinklers). Because I grew up in coastal Southern California, it wasn't long before I was introduced to the ocean, which was initially overwhelming and later became irresistible. During my adolescence, I considered pursuing a number of different professions but, in the end, I chose to study water and the oceans—not because I thought it would lead to the best career, but instead because I felt an inexplicable draw. In retrospect, I suspect the draw resulted from a sense of wonder and the prospect of my being able to both witness and perform magic.

My introduction to working in the field of water commenced with earning a bachelor's degree, at which time I was employed on a research project designed to assess baseline conditions in coastal marine ecosystems for the grim purpose of evaluating the anticipated impacts of crude oil spills. Since those early days as a field ecologist, I have been involved in water resource management (both fresh and saline), pollutant investigations, and *in-situ* remediation technologies. Whether serving as a consultant, reviewer, or applied researcher, my experiences have been remarkably similar with respect to the manner in which water and the natural world are apparently perceived by both professionals and laypersons.

Generalizing about the perceptions of a society is admittedly precarious given the diversity of individual viewpoints; however, trends or consistencies in people's expectations, approaches, and reactions to water and environmental "crises" are discernible if one looks for them. While I was not looking for such trends when I began my career, I have developed a fascination with people's perceptions of water—and especially those of my own.

The origin of my fascination with the predominant view of water held by people in today's industrialized Western world may be traced to a long-standing disappointment and a corresponding realization. My disappointment stemmed from the observation that our best human efforts to remediate the damages or transformations we have inflicted on water and watery environments are largely ineffective (although certainly not inexpensive) and that the real remediation is always accomplished by Nature over considerably longer time periods than we consider to be acceptable. Whether the damage results from chemical pollutants, man-made structures, or our extracting more from the natural world than it can sustain over a given time period, the most effective "remediation" necessitates our interfering with the natural world as little as possible and, perhaps, removing our most egregious contamination and disruptive physical structures in order to allow Nature to operate more efficiently.

Most of my work now focuses on learning how natural systems (particularly aqueous ones) self-remediate and how best to support, rather than outsmart, the perfectly adapted combination of physical, chemical, and biological processes working in concert to perform feats that cannot be matched by even the most brilliant man-made schemes. Whereas my realization that only natural processes can restore natural systems may sound rather obvious, it does beg the question of why so much emphasis continues to be placed on fixing things that we cannot fix and so little emphasis placed on respecting things that we cannot comprehend.

My observations suggest that one reason for this misplaced focus may be that our understanding of cause-and-effect relationships in the natural world is considerably more rudimentary than we realize. Although we openly acknowledge the mystery and wonder of Nature, we often act in ways that do not jibe with such an acknowledgment. Why so? I believe that our respect for the natural world is primarily

based on an intellectual appreciation, rather than an inner sense of awe or a true reverence.

Because of my lifelong interest in water, I began asking myself how I perceive water and if my perceptions appear to be shared by others within my profession and society. How might our collective perceptions have served to create and sustain the current worldwide water crises? I asked myself this question not in an attempt to affix blame for our water crises, but rather in search of a perceptual shift that might assist us in short circuiting an all-too-familiar cycle. The cycle begins with our creating systems or products that inadvertently impact the natural world in fulfilling their objectives, and the cycle is sustained by our attempting to lessen or remediate those impacts via the use of new systems or products that focus on the most obvious problems but, in doing so, create their own unanticipated and often unacknowledged impacts.

I was well into my career when I realized that my perception of water and the natural world had shifted from the wonder and magic that initially motivated me to enter the field. Essentially, I (or at least an aspect of me) had come to view water as an ordinary commodity and the oceans as a human resource. I found myself talking about water in terms of cost-benefit analyses and regulatory statutes, as well as advocating engineered changes to the chemistry of natural waters in order to immobilize or detoxify particular contaminants. Where was my former respect for Nature? How had my strong inner sense of and connection to water been occluded or supplanted by these intellectual perceptions, which now appear to me as self-serving and narrowly focused? How had my perceptions of water been altered, and why had seemingly similar perceptions of water achieved the status of dogma in our society?

I had these questions in mind when I wrote my first book, *Universal Water*; however, it took the cumulative responses of its readers to initiate my addressing the perception of water in a more forthright manner. *Universal Water* focused on two very different ways of perceiving water—namely, postmodern scientific theories and so-called ancient wisdom. My intent was to present novel ways in which people living in the postmodern industrialized world could perceive the role of water inside their bodies, on our planet, and within the universe. Constructive feedback I received from readers generally

included three suggestions or requests. The first was to sequentially trace humanity's dominant or prevailing perceptions of water, either along a timeline or as a historical perspective, such that readers could more easily see how we have arrived at our commonly held world-views. The second was to expand beyond the scientific and ancient views of water to include significant social, political, religious, and economic trends that have contributed to the perceptions of water held collectively by postmodern Westerners.

Fulfilling the requests could have included my writing a series of lengthy books—something that I was unwilling to do and that would have conflicted with their third request, which was to make this book as brief and nontechnical as possible. In deference to these reader requests, Chapters 2 through 4 present my interpretations of humanity's prevalent perceptions of water over the last two millennia, as well as pertinent changes in people's attitudes and understandings that seem to have set the stage for our postmodern perceptions of water. Although this book has numerous references to science, I have restricted those references to topics that I consider pertinent to a chronology of broader water perceptions.

The next request came to me from a friend who politely pointed out that if my intent was to assist people in altering their perception of water, it might be worth my discussing the topic of perception itself and, if possible, the processes that contribute to it. The subject of perception (human and nonhuman) is nearly as broad and almost as controversial as that of consciousness. While I managed to sidestep the question of water's consciousness in *Universal Water*, there was never a doubt about my having to delve into the subject of perception in this book. Adhering to the themes of brevity and technical simplicity, I wrote Chapter 1 to provide a general introduction and to present the terminology that I will use throughout the book. Chapter 1 explores conventional and unconventional ideas regarding perception, including descriptions of nonhuman perception and of some people's ability to recognize and interpret environmental signals that are never registered by our five physical senses. Chapter 1 also introduces the topics of cellular perception and perceived causality, both of which profoundly affect our views of water and the entire natural world.

Finally, people who attended my lectures generally had two requests. The first was to put our collective perception of water into some context with regard to the current worldwide water crises. The second was to suggest ways in which we might go about changing our perceptions and to speculate on how such changes (assuming we made them) might alter the more traditional views of allocating and preserving water, such as those held by many of today's water rights proponents, environmentalists, and conservationists. In Chapters 5 through 7, I examine the underlying (and often hidden) assumptions and expectations that we have about water, offering suggestions for making these assumptions and expectations more visible and less habitual. In doing so, I examine some ways in which others have overcome an entrenched view of water or the natural world by supplementing their intellectual attitudes and understandings with experiential and/or intuitional insights.

The final chapter is at least partially autobiographical inasmuch as I discuss a few of my own perceptions of water (especially seawater) and how I have attempted to integrate my scientific views of water with my personal experiences of and intuitive insights about water. I initially resisted adding the last chapter because I did not want readers to interpret it either as a model or as a testimonial to my having achieved a balanced perception of water. On the contrary, I am very much in the process of balancing my predominantly intellectual perception of water with experiential and intuitive perceptions that I have long ignored or trivialized.

The fact that the world's attention is turning more and more toward water is certainly no coincidence. All of the environmental problems and many of the economic and political problems we face at the dawn of the new millennium are directly or indirectly related to water—often in ways that we simply do not realize. Our inability to recognize water's roles in these crises is, more often than not, a result of viewing water through a very narrow aperture and a poorly focused lens. I believe that our challenge may be to perceive water in a more expanded and interconnected manner and, at the same time, to continue utilizing water in the essential, but seemingly mundane, ways that sustain us and the many other life forms on this planet.

Altering our collective perception of water need not be viewed as a disagreeable task that we are required to perform, but rather as an

opportunity to know and revel in a watery world that may never again appear quite the same to us. To take advantage of this opportunity, we have to be willing to try out, or perhaps to try on, perceptions of water that have been overlooked or discarded by our postmodern Western culture.

D.L. "West" Marrin
Island of Kaua'i
Summer Solstice 2006

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PERCEPTION: *PRIMARY AND OTHERWISE*

"Thus the Tao is the course, the flow, the drift, or the process of nature, and I call it the Watercourse Way because both Lao-tzu and Chuang-tzu use the flow of water as its principal metaphor... As Chuang-tzu says, "It may be attained but not seen," or, in other words, felt but not conceived, intuited but not categorized, divined but not explained."
Alan Watts[1]

We have reached a pivotal point in our dealings with water in the postmodern world, such that we have actually begun transforming the global water cycle in significant ways (e.g., diverting and storing surface waters, mining aquifers, altering land cover).[2] Because scientists do not fully understand the workings of this complex water cycle, the consequences of our transformations are difficult or impossible to precisely identify; however, the global impact of direct human intervention in the terrestrial water cycle is anticipated to surpass that of climate change in the upcoming decades. And this impact does not even consider the effects on oceanic systems, the magnitude of which cannot be projected at this time. In addition to obvious effects such as floods, droughts, and destruction of aquatic habitat, scientists now suspect that human interference in the global water cycle may have affected the spin of the Earth, the atmospheric loading of greenhouse gases, and the balance of organisms in critical environments. If this is true, our postmodern crises such as global climate change and worldwide disease epidemics may prove to be unrecognized consequences of our intervening in the global water cycle under the auspices of water engineering projects or watershed management practices (both planned and unplanned).

It is also widely recognized that dealing with global issues (e.g., water crises) via a complex web of international, national, regional,

and local authorities may not succeed in the long run. I do have faith in technological advances, which emerge from new applications of science's physical laws, to provide short-term solutions to our challenges; however, I do not believe that any permanent solution will result solely from their application, as will be explained throughout this book. Does this mean that we cannot go on as we are? No. It simply means that we have the opportunity to make different kinds of decisions and to approach our challenges with water in seemingly unorthodox ways. To take advantage of this opportunity, we need to perceive the natural world a little differently.

Perhaps the real opportunity we postmodern humans are being afforded at this point in history is to perceive the world from the combination of intellectual, experiential, and intuitive vantage points. This altered perception amounts to our balancing between different modes, as opposed to just substituting one mode for another. But before the pendulum can swing back to a more balanced perception, we need to recall what tools are available to us. This book examines how we may have lost some of our perceptual tools, and how we may best reclaim them. In my view, our most fundamental challenge with water is how we perceive it, as opposed to what we do with it. The latter is always an expression of the former.

How do you perceive water? Would it surprise you to learn that most of what you think you understand about water (from a strictly intellectual standpoint) is probably either incorrect or outdated? For example, water exists throughout the universe in one of its three phases (solid, liquid, vapor), where it influences the appearance and birthing of stars. Various forms of water essentially set the planetary climate regimes (in response to solar energies) and its vapor is the only greenhouse gas capable of influencing global warming on a short-term basis. Liquid water is not just the solvent or for earthly life forms; it is the actual matrix within which all biological structures and processes exist. In other words, water is both a builder and a constituent of life's biomolecules (e.g., DNA, proteins), and it is intimately involved in the communication between and functioning of these biomolecules. Earthly life may be viewed as animated water that achieves its diversity from the different mixtures of substances that it dissolves or suspends within an organism. How can a simple H_2O molecule perform such feats? The answer is that water is not

just a random grouping of molecules, but instead represents an indescribably complex network containing countless components that function on the timescale of about a trillionth of a second.

Our intellect and physical senses alone simply cannot provide us with a realistic perception of water or, for that matter, of most of the natural world. So, how else can we perceive water? To answer this question, we have to explore perception beyond its colloquial limits.

WHAT IS PERCEPTION?

According to definition, perception refers to *a cognition or apprehension obtained through the senses and intellect, as well as to ideas or notions arising from such knowledge.* This definition is highly recognizable postmodern Westerners because we derive our ideas of the world almost exclusively through our sensory and intellectual capabilities.

In addition to this very familiar use of the word "perception," there exists another and more obscure meaning that refers to *the quality or capability of being affected by something external.* This definition of perception is often identified with the essays of English philosopher Francis Bacon; however, it is also prevalent in many of the writings of contemporary naturalists and in the stories passed down to indigenous peoples by their ancestors. The controversial research of biocommunication expert Cleve Backster is perhaps the most renowned for describing this obscure form of perception, which he posits is responsible for plants' ability to receive and react to signals emanating from other organisms (e.g., humans). In other words, his theory is that plants attune themselves to other organisms in their physical environment and predictably react to threats posed to those organisms—even when such organisms are removed from the plant's immediate surroundings. In the words of Cleve Backster:[3]

> *Early on I began to suspect that a kind of perception was being demonstrated that was likely more basic or more primary than our traditional views on perception. This led to my use of the term "Primary Perception."*

According to most botanists, plants possess neither the mind nor sensory nervous system required to exhibit behaviors corresponding to the traditional definition of perception; hence, Backster concluded

that the plants must rely on a more fundamental or primary mode of perceiving the natural world around them. Whereas primary perception may be an unfamiliar label for an organism's ability to tune into its environment, similar abilities are described in the stories and rituals of many ancient and indigenous cultures. For example, both the native North Americans and Australian aborigines describe their bond to the Earth and to the surrounding plants and animals. This bond, or intimate connection, is evidently felt or perceived in a manner that conveys information about the well-being of their planet and fellow species.

Mythologist Tamra Andrews notes that over two hundred different ethnic groups native to North America recognize the natural world as a sacred space, where they commune with and feel the very spirit of everything in their environment (e.g., rocks, animals, plants, water).[4] Essentially, they access the divine wisdom of the spirit world through their relationship to the natural world, which is experienced as interconnected and communicative. Similarly, native Australians know their intimate connection to and responsibility for the Earth through the so-called *Dreamtime*, which reveals to them the sacredness and interconnectedness of Nature.[5] Whereas ancient and indigenous cultures did not necessarily leave their environment or fellow species unscathed in acquiring the resources needed for their survival, most of them did exhibit both a reverence for and a relationship with the natural world that is absent in many postmodern Western cultures.

From the perspective of contemporary indigenous cultures, the ability of any aspect of the natural world to be cognizant of and sensitive to any other aspect is not only commonplace—it is mandatory. That is to say, the very existence of ancient peoples was predicated on their ability to receive and interpret signals within their environment that we postmodern people seemingly have no need to recognize—or so we assume. Unable to cognize or feel a subtle connection to the natural world through our logical or gross sensory capabilities, we postmodern Westerners either doubt that such a connection really exists or attribute it to a kind of mystical state or extrasensory perception.

Extrasensory perception, or *ESP*, is a term that conjures up visions of people sitting in locked rooms and relating events that are occurring across the hall or halfway around the world. Actually,

extrasensory perception simply refers to an ability to perceive aspects of our environment that lie beyond the limits of our gross senses (i.e., touch, taste, hearing, sight, and smell). As discussed in the following section, individual cells comprising all biological life routinely perceive and react to natural forces that are never registered by the five human senses.

CELLULAR PERCEPTION

What do we know about the biology of cellular perception that might suggest to us that all organisms (i.e., humans, bacteria, plants) are able to perceive their environment on many different levels? Well, we have to look no further than common medical problems and treatments to get our answer. Our blood cells perceive and react to odorless gases such as carbon monoxide in air, while the cells in our digestive system react to tasteless substances like arsenic in water. Our muscle cells react to mechanical waves in the form of ultrasound that we cannot hear, and our skin cells react to electromagnetic waves in the form of ultraviolet light that we cannot see. Finally, all the cells in our body perceive and react to tiny particles in the form of radionuclides (radiation) that we cannot feel.

Science has uncovered thousands of different forces, energies, particles, substances, and fields that are perceived by our cells, but not by our five gross senses. By gross senses, I am referring to the human physical senses unaided by technological innovations (e.g., microscopes, gas analyzers, radiation detectors). Hence, the billions of cells comprising our bodies and those of our fellow species are masters of ESP, at least according to its most basic definition.

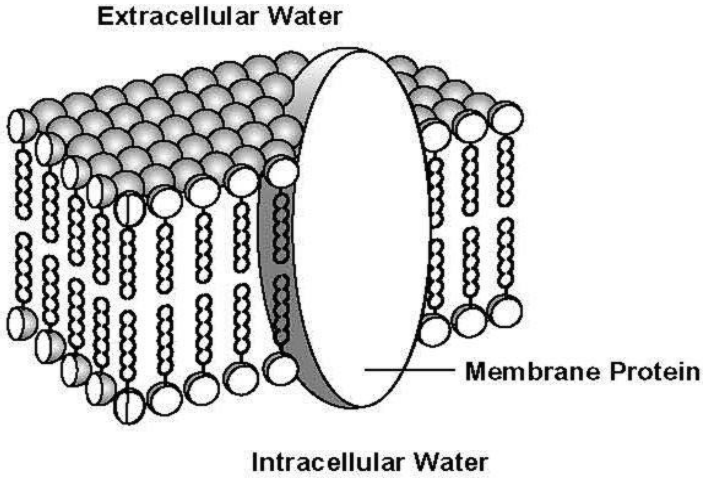
So, what exactly permits biological cells to perform these feats of extrasensory perception? The answer is an amazing structure that biologists refer to as a *cell membrane*, which not only envelops the entire cell but also regulates the flow of matter and energy in and out of it. Cell biologist Bruce Lipton explains that embedded in all membranes are specialized proteins, which are tuned to specific signals (e.g., chemicals, vibrations, fields) that trigger a shift in protein shape or geometry.[6] This shape-shifting serves to activate the protein by changing the electrical properties of the membrane and, in doing so, permits cells to perceive their environment. Lipton theorizes that the

cell's membrane, rather than its nucleus, actually controls cellular life and acts as "the brain" in translating environmental signals into functional behaviors.[7] He compares the cell's nucleus to the hard drive of a computer that stores countless DNA programs for encoding the assembly of proteins. Where, when, and which proteins are actually produced, however, is determined by the environment, as opposed to the genetic code.

If the cells within our body can perceive such a wide range of environmental signals, then why are we not aware of them through one of our five senses? The most common answer is that complex biological organisms (e.g., humans) generally interact with their environment via a specialized class of cells known as a nervous system, which is designed to process the few signals to which it is tuned (representing a tiny fraction of the signals that are present in every moment) and, within that tiny fraction, only to signals that exceed a certain threshold. The more unconventional answer is that most all environmental signals can indeed be perceived, but not using our physical sensing channels. Bruce Lipton maintains that all biological organisms are able to communicate with and read their environment by evaluating energy fields; however, the majority of postmodern humans have become so dependent on speech and writing that they have neglected their energy-sensing systems.[8] By way of example, he cites the ability of Australian aborigines to sense groundwater sources in desert regions and of Amazonian shamans to communicate with medicinal plants in the jungle. An even more controversial form of communication is discussed in the next section.

Before leaving the subject of cell membranes, there are a couple of additional points that are germane to our topic of water. Due to the molecular design of cell membranes, water in the form of *intracellular* and *extracellular* fluids (present inside and outside the cell, respectively) must be present for membranes to function (see Figure 1-1). Besides hydrating the membrane, water plays a major role in determining its electrical properties that, in turn, affect the cell's perception and communication. Specifically, the molecular structure of water (referring to both the extent and geometry of connectedness among individual H_2O molecules) that comprises all life-sustaining fluids is instrumental in determining the cell membrane's electrical properties.

FIGURE 1-1. A typical membrane is composed of two different kinds of molecules that act cooperatively to keep fluids inside the cell from randomly mixing with fluids outside the cell. Intracellular and extracellular waters are very different in both their composition and their function within biological organisms. Subtle changes in the structure of these waters affect the membrane's electrical properties that permit the cell to exchange matter, energy, and "information" with its immediate environment. Reprinted from *Universal Water*.[9]



The presence of these fluid layers adjacent to membrane proteins means that all environmental signals reaching the cell must first be transmitted through water. Environmental signals initially affect the molecular structure of the water, which functions in concert with the membrane and its components (most notably its embedded proteins), permitting the cell to perceive its environment. Hence, biological organisms perceive everything in their environment through water! Although every person physically perceives his or her world through water, there are enormous and very significant differences in how people perceive water in their world.

ETHERIC PERCEPTION

Returning to Cleve Backster's experiments on primary perception, we are introduced to his deduction that the signals perceived by the plants are likely transmitted through a so-called *etheric field* because the transmissions seem to transcend both space and time.

Essentially, his hypothesis is based on the physical limitations of transmitting signals through conventional means such as chemicals, sounds, or even electromagnetic waves, which are all limited to the speed of light. While all forms of ESP need not invoke the etheric field as a medium (e.g., conventional energy fields may transmit information that is unrecognized by most postmodern Westerners), there are many studies suggesting that such a field must be involved.

Subsequent chapters of this book review both historical and contemporary views on the relationship between water and aether; hence, I discuss only the perceptual aspects of such a field in this chapter. Controversial views of aether and its relationship to the observable world are reviewed in the first section of the Appendix.

Recent conceptualizations and definitions of the *A-field* (where "A" refers to the ancient terms *akasha* or *aether* appearing in the Sanskrit and Greek languages, respectively) are presented in a recent book authored by the prolific science writer Ervin Laszlo.[10] Laszlo argues that we are currently ripe for a scientific paradigm shift, which is necessitated by science's inability to reconcile many of its most recent findings (e.g., universal expansion, dark energy, dark matter, nonlocal events) with existing paradigms. The word "paradigm" in this context refers to an accepted model that gains its status with the scientific community because of its success, relative to competing models, in solving the problems that the community considers to be important. It was Thomas Kuhn who first provided a definition for scientific paradigms in his essay *The Structure of Scientific Revolutions*.[11] Laszlo notes that akasha is the quintessential Element (giving rise to *fire*, *air*, *water*, and *earth*) and source of the legendary storehouse for universal memory known as the akashic records. He has ascribed the following general properties to the A-field:[12]

- **Informational:** the storehouse of memory that guides and connects all of Nature through the mechanism of sympathetic vibration or resonance.

- **Universal:** applicable to all scales of Nature (i.e., quantum to cosmic) and derived from a previous universe or a vaster realm known as *Metaverse*.

- **Holographic:** stores information as wave interference patterns (owing to countless individual vibrations) that appear as three-dimensional images.

It is interesting to note that a number of postmodern scientists and philosophers have hypothesized that these three properties are fundamental to etheric fields. Inventor and visionary Itzhak Bentov referred to the hologram as *universal mind* because each individual in the universe both accesses (depending on his/her/its level of consciousness) and contributes to the memory.[13] But how do we access the three-dimensional images emanating from the universal mind? According to Bentov, we do so exactly the same way that the *reference* and *working* beams of a laser light produce images on a photographic plate—namely, by interpreting wave interference patterns.

In essence, Bentov posits that we compare the reference beam of our existence (i.e., the nonmovement of pure consciousness or the so-called *Absolute*) to the working beam of our existence, which transmits complex wave patterns of the A-field resulting from continual movement or vibration. Ultimately, both beams emanate from the same source, which is the Absolute. According to Bentov's model, we interpret movement or patterns of vibrational energy as a world of space, time, and matter. Whereas the A-field is manifested but unobservable, the Absolute is unmanifested. He posits that the perceptual ability of any aspect of creation (e.g., humans, plants, rocks, stars) depends on both the number and types of interference patterns that can be interpreted within the A-field.[14]

So, what might these unusual theories offer us regarding the topic of etheric perception? Is etheric perception the primary mode by which every aspect of Nature perceives its environment? While the ultimate answer may be "yes," most of us postmodern Westerners have been taught to understand the world in a way that does not readily accommodate such a possibility. Why so? One reason seems to be that we have become almost completely dependent upon perceiving our world through the intellect and physical senses—including both our gross and extended senses. The latter senses are those dependent upon technological advances, allowing us to detect fields, particles, and forces that we could not otherwise perceive. Technological advances constantly expand the limits of our extended

senses; hence, such limits have no relevance to the totality of the universe. Moreover, if we accept the insights of nearly all indigenous peoples, such limits have only partial relevance to our perceiving the universe.

CHANGING PARADIGMS

It is important to understand that new scientific paradigms simply represent a shift in the collective perception of scientists, who are faced with the failures of trying to fit Nature into their previously useful boxes. If science is indeed teetering at the brink of a paradigm change, are people outside of the scientific community on the verge of a perceptual shift as well? Perhaps they are, but not necessarily because science is.

One of Thomas Kuhn's observations regarding science and its paradigm shifts is the extent to which they are insulated from "the demands of the laity and of everyday life."[15] Whereas science-derived technologies have expanded into the lives of postmodern laypersons, this expansion seems to have been more fortuitous than deliberate. Additionally, science has influenced our lifestyles more than our life's meaning, our ability to use water more than our ability to perceive water, and our alleged mastery of the natural world more than our sustainable existence within the natural world. It is worth noting that the so-called New Age trend of drawing upon recent scientific advances to assist in shifting the way laypersons perceive and connect to the natural world has been initiated predominantly by scientists, naturalists, writers, and philosophers who work either outside or at the fringes of the mainstream scientific community.

Whether or not Ervin Laszlo is correct in his hypothesizing that the scientific community is undergoing a paradigm shift, the larger question seems to be what effect (if any) such a shift might have on the collective perceptions of those outside the community. I believe that the answer to this question hinges on two factors, including the success of nontraditional science communicators in both explaining and practically demonstrating to laypeople the relevance of scientific paradigm shifts, as well as the willingness of all people (including scientists) to integrate the principles of such shifts into their everyday perceptions and actions. Whereas the latter task may appear simple

at first glance, bear in mind that the implications of scientific paradigm shifts may conflict with personal, societal, religious, and other well-established or cherished ways of interacting with the natural world. Just as scientists have historically resisted major paradigm shifts in their profession, so too have most people resisted major changes in their lives.

Besides integrating current scientific thought into the perceptions of the natural world held by laypeople, there has been a recent trend to integrate some of the techniques and philosophies of Eastern traditions (e.g., Hindu, Buddhist, Taoist). Philosopher Alan Watts described Taoism as the way of human cooperation with the natural world that may be observed as organic patterns, such as those present in the flow forms of water or the grain of wood.[16] Not unlike the A-field, the Tao is often described in terms of a formative energy or field. Watts contrasted Taoist perceptions of the natural world with scientific paradigms, which propose cause-and-effect relationships that we cannot understand and that perpetuate the discovery of details requiring endless investigation and explanation. He speculated that our investigations would never cease because the patterns of energy we seek to explain are infinite in both their diversity and scale (e.g., ever smaller particles and ever more galaxies). According to this worldview, our modern concept of causality (upon which the natural sciences are largely based) is a method of connecting various stages of an event that have been separated for purposes of description; however, the natural world is itself a single event, as opposed to many different events linked together by causality.[17]

Whereas the definition of Nature as a single event is probably unfamiliar to most of us, the notion that our perceptions of the natural world may be based (at least to some extent) on misplaced or incomplete causality may be more familiar and comprehensible. According to renowned mathematician and cosmologist George Ellis, true complexity occurs in modular or hierarchical structures, such that the emergence of higher levels of order and meaning result from a degree of organization that is not present in the lower levels.[18] In addition, causes within those higher levels of the hierarchy have substantial effects on the lower levels, thus complicating cause-and-effect relationships that are interpreted solely from the lower levels of the hierarchy (i.e., those derived from scientific reductionism).

Applying this principle to water suggests that no matter how much we study its component molecules or atoms, we simply cannot understand its functioning as an extended molecular network (e.g., the fluids bathing cell membranes) or as a constituent of higher-level physical structures (e.g., lakes, planets, stars). Perhaps worse, we cannot fully understand causality within the atomic and molecular realms because causes inherent in the complexity of higher-order layers exert their influence without our realizing it. In many esoteric traditions, the consciousness associated with any particular level of the structural hierarchy is known as *devic*.[19] Hence, many indigenous peoples claim to communicate with devas of the oceans, mountains, trees, etc. George Ellis surmises that the reason reductionist physics is still unable to address consciousness—let alone devas—relates to misplaced causality, as is explained in this quotation:[20]

> *Paradoxically, although the higher-level properties emerge from the lower-level processes, they have a degree of causal independence from them. Higher-level processes operate according to their own higher-level logic. Physics [lower-level processes] makes possible, but does not causally determine, the higher-order layers.*

From an intellectual viewpoint, misplaced causality acts as a major stumbling block to understanding of water—even according to research methodologies that clearly do not belong to contemporary mainstream science. The notion that our understanding of Nature is based on incomplete or erroneous cause-and-effect relationships not only affects science, but it also questions many assumptions upon which our technological and industrial societies are based. Some philosophers believe that seemingly contradictory worldviews, such as those described for science and Taoism, are currently in the process of converging. Absent such a convergence, are we postmodern Westerners likely to adopt a radically different perception of the natural world? For most of us, the answer is probably "no." So, what is likely to motivate people to adopt such a change?

I have observed that people are more apt to make lasting changes when motivated through personal insights or experiences than when motivated solely through intellectual rhetoric or shifting paradigms—whether the paradigms are scientific, philosophical, socio-political, or

religious. Accordingly, a major focus of this book is the intuitional and experiential tools available for our supplementing intellectual processes and, perhaps, altering our collective perceptions of water and its associated crises.

PERCEPTUAL MODES

Although Chapter 5 addresses intellect, intuition, and experience, I have arbitrarily selected these three modes of human "knowing" to describe our many and varied perceptions of water. Whereas some people may consider these three modes to be realistically inseparable, others would subdivide them into even more categories.

- **Intellectual:** gained through reasoning or logical association; often described as a combination of observing (via one's gross and extended senses) and thinking; dependent on the mental processing of information.

- **Experiential:** derived from direct involvement in an event; often described as a combination of feeling (via one's subtle senses) and observing; dependent on the immediate presence of that being perceived.

- **Intuitive:** acquired without reasoning or logic; often related to instant feelings or apprehensions; dependent neither on the mental processing of information nor on the immediate presence of that being perceived.

At least with respect to humans, none of these three modes of "knowing" the natural world are either developed or practiced in isolation. For instance, experiencing the natural world has been shown to assist in the discovery, use, maintenance, and perhaps even the validation of our intuition.[21] Often described as modular systems, increasingly complex forms of matter appear to interact with their environment in ever more expanded ways—perhaps determined by their ability to recognize and interpret interference patterns within the A-field.

In general, experiential knowledge is considered to be the most fundamental form of perceiving the environment (e.g., primary perception in plants) and the most rudimentary mode of perception in

humans. Intuitive and intellectual knowledge are often described as increasingly expanded modes of accessing the so-called universal mind. However, any attempt to ascribe levels of consciousness to the three modes of perception is complicated by their hypothesized presence in widely diverse aspects of Nature. Perhaps arbitrarily splitting perception into such modes belies the truth that perception is a single event (as is the entire natural world), within which we recognize various stages that are simply identified as different modes. We live in a world composed of patterns that are recognizable in both time (e.g., cycles, rhythms) and space (e.g., geometries, waves), and that differ principally in scale or magnitude. Our recognition and interpretation of these patterns, whether they exist in water, wood, stars, or the A-field, may ultimately determine how and what we perceive around us. Even a minuscule expansion in the patterns that we are able to discern through our available modes could profoundly change our perception of the natural world. I conclude this chapter with a quotation from environmental educator Joe Sheridan, who recognizes that any single mode of perception is not necessarily superior to any others and that all modes are required to resonate with the organic patterns of the natural world and to live in harmony with Nature.[22]

> *The process of noticing and apprehending the natural world through lived experience lays a foundation for subsequent noticings and apprehensions . . . Creative thought, or the ability to see a variety of patterns between things, is where intuition intersects, in this regard. My co-author and I believe intuition may be the resonance with those patterns.*

2

ANCIENT: *PRIOR TO THE FOURTEENTH CENTURY*

"It's those types of rituals that I think are the sort of myths and legends of life that we've lost in our society. We don't know how to ritualize water. We just turn on the tap and there it comes, but we don't have the sense of benediction for water."
Anita Roddick[1]

It appears that many ancient peoples intuited and/or experienced a connection between water and the process of creating the material world. Water was a tangible link between the manifested realm they perceived with their gross senses and the realm of Spirit that they perceived with their hearts. Their knowing was based neither on an intellectual understanding of water's physical properties nor on its value as a commodity, but instead on an intimate relationship with water's essence. Most of us postmodern Westerners have an admittedly difficult time even fathoming what it is to know water's essence. We acknowledge (intellectually) that water is essential for biological life and is aesthetically pleasing; however, we certainly do not relate to water as animate or sentient or truly sacred.

Did these ancient perceptions of water simply die with their respective cultures or were they somehow carried forward in time? The answer is twofold. Many of today's indigenous peoples, especially those with limited exposure to the industrialized world, have retained a perception of water similar to that of their ancestors. This is not true for most people in today's industrialized world due, in great measure, to a gradual shift in our view of water that began during the Renaissance era and has left us with only assorted relics of our ancestral perceptions.

Throughout this chapter, I will refer to various perceptions, beliefs, and understandings that are attributed to both ancient and present-day indigenous peoples. There are a couple of factors to bear in mind as you read this material. First, not all people from such

ancient cultures necessarily shared the perception or belief that is described; however, writings left behind and stories passed down through time suggest that specific types of perceptions were more prevalent or accepted than were others. Second, not all indigenous people subscribe to the rituals, beliefs, or wisdom of their ancient ancestors. Some indigenous persons have adopted perceptions more closely matching those held by people in industrialized Western societies, while others have integrated beliefs from their own and their adopted cultures. Hence, my use of the word "indigenous" throughout this book is predominantly in terms of beliefs, rituals, and perceptions, rather than in terms of ethnicity or geography.

A CREATIONAL METAPHOR

People from many ancient cultures believed that the material world owes its very existence to a primordial state of chaos, which represents a formless state from which all forms arise. Of all the ancient metaphors used to describe this original state of chaos, water appears to have been the most popular (at least according to translations into the English language). A sixth century B.C. philosopher named Thales, who lived in what is now Turkey, hypothesized that water was the primary substance of all being. As perhaps the first true water "expert," he proclaimed that water was the original substance of the universe out of which everything is created and to which everything returns. Naturalist William Marks notes that Thales is often considered the founder of natural philosophy and that his contributions were so profound and enduring that he was canonized as the wisest member of the Seven Sages of Greece.[2]

According to the earliest civilizations of Mesopotamia, everything was born from a watery place that represented the primordial chaos. Mathematician and cosmologist Ralph Abraham has traced the origin of this the word "chaos," not to disorder, confusion, or randomness, but to the source of all worldly forms that is commonly known as the *waters of chaos*.[3] Similar to ancient myths from the Mesopotamian region, Vedic and Taoist traditions recognized water's connection to everything, whereas the Bible's Book of Genesis identifies water as the primal substance over which the Spirit of God was hovering before the creation of Heaven and Earth. Similarly, the Koran ac-

knowledges Allah's creating all forms of life from water. Kabalistic traditions maintain that water both gives rise to matter and acts as an undifferentiated fluid.[4] While clearly distinct from the primordial chaos, or *tohu*, water was understood to receive its structure from something outside of itself and to be "the" physical expression of a spiritual force that permeates the higher realms or dimensions of our unobservable world.

The Egyptian Sun god known as *Ra* supposedly appeared above the waters of chaos as one of the first acts of creation, thus signaling the beginning of time.[5] Ra made his journey over the water in a boat because the Sun was made of fire and, therefore, could not have risen out of the waters of chaos on its own. In contrast to a fiery creator, most interpretations of Hawaiian mythology maintain that the primary creational god *Kāne*, who is intimately associated with water in the physical world, manifested Heaven and Earth from the original chaos. The Chinese was one of only a few ancient cultures that did not associate the primordial chaos with water in the form of a sea or river. Instead, the ancient Chinese apparently portrayed the chaos as a misty vapor that gave rise to all earthly life forms through the duality of *yin* and *yang*. Whether portrayed as a primordial sea, an underworld river, or a misty vapor, ancient peoples appear to have routinely used "the waters" to describe a pre-creational chaos.

What insight were ancient people sharing with regard to the watery nature of the primordial chaos? The most common answer seems to be that waters best symbolize a formless, fluid, unbounded, and undifferentiated state. The waters of chaos were believed to possess a storehouse of unmanifested possibilities, such that they could give rise to form from their very formlessness. The act of creating forms from a boundless sea of infinite potential was often used to describe the emergence of the material world.[6] Another clue as to why ancient people used "the waters" as a metaphor for the primordial chaos may be rooted in a seemingly pervasive belief about the physical substance of water itself.

A LIVING MEDIATOR

Myths from a variety of ancient and indigenous cultures have been interpreted as indicating that water mediates the transition of

physical forms between the unseen and seen worlds (i.e., Heaven and Earth, respectively). The insight that all worldly forms emerge from the waters (the metaphor) through water (the mediating liquid) and eventually return to the waters through water has been handed down to us, in one rendition or another, from a variety of ancient sources. While ancient peoples probably did not actually observe worldly forms emerging from liquid water, they seem to have intuited that water was somehow instrumental in the process of mediating, or facilitating, the entrance and exit of physical forms from the unseen world. Note the difference between the unseen world, which was apparently considered an aspect of creation (i.e., Heaven or the etheric realm), and the pre-creational chaos (i.e., the infinite potential from which both the seen and unseen worlds were created).

Water capable of mediating the transition of forms or energy between the seen and unseen worlds was considered by many cultures to be so sacred that it was given the name *living water*. Although the physical substance of living water is generally understood to have been distinct from the metaphoric waters of chaos, the perceived manifesting role of the former may have influenced ancient people's selection of a metaphor for the latter. While we may never know why ancient peoples selected "the waters" to describe a pre-creational chaos or how they arrived at the understanding that living water mediates between the seen and unseen realms, what we do know is that water played a pivotal role in their respective cosmologies.

As an example, the Mandaeans are a small group of indigenous people living in the Middle East who have retained the language, religion, and traditions of their ancient Gnostic sect. In their religion, water provides the connection between the earthly world and the world of the light.[7] It is water that mediates between the life-creating aspect of the light world (i.e., a heavenly or etheric realm) and the observable world (i.e., a material realm); furthermore, living water is responsible for the intimate connection between the two realms. According to the Mandaeans, only one part in nine of water on this planet is considered living and able to mediate between the worlds.

The Bible portrays living water as both a source of life and a gift from God. In fact, Jesus himself was often symbolized by water. Living water was considered to be distinct from ordinary water and was able to produce a so-called paradise on Earth. According to the

Christian tradition, God is the source or fountain of living water, which is not just a liquid with which to bathe your body or to quench your thirst—but rather a liquid that gives life itself. There is a clear distinction between living water and both the commonplace water we find in our environment (appropriate for most purposes) and the ceremonial water (also known as *holy water*) that is blessed by a religious figure for use in various rituals. Living water was the one substance that mediated between the apparent chaos of God's realm and the perceived order of the manifested world. In addition, living water often reached its destinations via springs and rivers that were known to freshen or transform the Earth as a means of imparting life or life-giving qualities. The terms "living water" and "water of life" date back to some of the earliest spiritual traditions emerging from around the world.

Australian aborigines, particularly those clans inhabiting the extremely arid interior of the continent, had a remarkable relationship to water. Because of their nomadic lifestyle, they had to find water wherever they roamed and apparently did so by communicating with the Earth and with the water itself. When last visiting Australia, I attended a spectacular showing of Aboriginal art and, upon entering the exhibit, I remember reading a quotation that concluded with the phrase, "Our Spirit Is in The Water." The link between Spirit and water is echoed by many present-day indigenous cultures.

The postmodern philosophy of *deep ecology*, which is credited to the Norwegian naturalist Arne Naess, expresses the view that every human has the ability to sense the natural world (including water), despite our beliefs to the contrary. The words "deep" and "ecology" are perhaps the most overused in the postmodern English language; nonetheless, Naess's philosophy posits that we humans are first and foremost a part of the Earth—emotionally, physically, and even intellectually. The illusion of an independent individual existence (i.e., one separate from Earth) is presumed to derive from our isolation and arrogance, which preclude us from feeling much of the planet's pain or remembering that Earth's fate is our fate.[8] Of all the beliefs attributed to ancient cultures, the ones describing the connection of humans to the Earth and its nonhuman inhabitants are perhaps the least represented in our contemporary Western cultures.

FROM DEITIES TO GEOMETRIES

The first generally recognized written history comes from the Sumerians, who inhabited the Mesopotamian region more than 5000 years ago. According to Ralph Abraham, there were four major gods that endured throughout Sumerian history.[9] *Enki*, who represented both water and wisdom, apparently evolved from the underworld ocean that created Heaven. *Anu* is considered the prime mover in creation who took over Heaven when it was separated from Earth, thus creating the universe as we now observe it. Enki was often depicted as a being with streams of water flowing from his arms.[10] Moving forward into the Babylonian civilization, the Sumerian name of Enki evolved into the Semitic name of *Ea*, which remained the personification of water or the deep. Ea's home was still considered to be the waters of chaos that existed before creation. As such, water served as the symbol of the primordial chaos in early Mesopotamia.

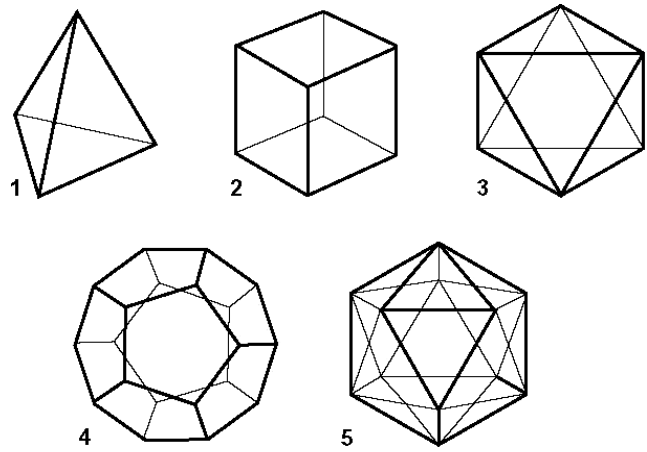
Water was understood by many in the ancient Greek culture to reside everywhere and to constitute everything, such that all things manifest in this world (e.g., stones, clouds, trees, people) simply represented different transformations of water.[11] Born from the primordial chaos or "waters" was Gaia, who was the first of all the Greek gods and who inhabited our planet after it was formed. Gaia breathed life into a lifeless planet and created the mountains, rivers, oceans, and other recognizable features that we now refer to as Earth. Note the distinction between the living spirit (Gaia) and the planetary form that serves as her physical body (Earth), not unlike the classic distinction of soul and body in humans. Gaia (the earthly mother) gave birth to *Uranus* (the sky) who became the lover and consort of his mother. Together, they gave birth to many Greek water deities such as *Oceanus*, who is often used to personify water's essence and whose name gave rise to the English word "oceans."

During the fifth century B.C., the philosopher Empedocles expanded on the insights of Thales by proposing that all matter in the universe was composed of differing combinations of four original substances and two moving forces. Empedocles referred to these four substances as the Elements of fire, air, water, and earth, and he identified love and strife as the moving forces. The moving forces essentially energized the combining or dissociating of Elements, such

that matter could neither be created without love nor uncreated (destroyed) without its opposite moving force of strife.

So stated, this theory of the four Elements has stood as a fundamental understanding of Nature for an astonishing number of ancient cultures around the world (e.g., Greek, Aztec, Hawaiian). Whereas the mix of Elements differed slightly among some cultures (e.g., the Chinese recognized wood and metal in lieu of air), all recognized water as a fundamental constituent of our world. The four Elements and the mysterious etheric substance from which they were believed to have emerged, were later associated with a special set of three-dimensional geometries known as the Platonic solids, which appear in Plato's *Timaeus* and are shown in Figure 2-1.

FIGURE 2-1. The five regular Platonic solids are the only angular three-dimensional geometries that are composed entirely of regular polygons and, when spun about their center vertex, create a sphere. The *faces* constitute the sides or exterior panels of the Platonic solids and are represented by a triangle, square, or pentagon. The *edges* are the straight lines that outline each of the faces, whereas the *vertices* are the points where two or more edges converge. The solids include a tetrahedron (1), a cube (2), an octahedron (3), a dodecahedron (4), and an icosahedron (5). Reprinted from *Universal Water*.[12]



The five regular Platonic solids, along with their number of edges, vertices, faces, and their corresponding Elements, are listed in Table 2A. These regular solids are correctly understood in an ex-

tended sense, whereby spinning them about the center vertex creates a circumscribed sphere. Sacred geometry associates the sphere with the infinite and undifferentiated Spirit and, as such, the Platonic solids are the only angular three-dimensional geometries that form a perfect interface with the primordial chaos. It is through these geometries that our material world (as angular geometries) was believed to connect to the Absolute, or original chaos (as a sphere). The icosahedron and dodecahedron (related to the so-called *golden ratio*) are considered to represent transcendent principles, whereas the octahedron and cube (related to the number 2 and its square root) operate at the level of the manifested world.[13] The tetrahedron is both self-reciprocating and the most fundamental of the solids.

TABLE 2A. The five Platonic solids as described by their number of edges, faces, and vertices as well as by their corresponding Element. Although aether was occasionally considered to be one of the fundamental Elements, it was usually designated as their source.

	TETRA-HEDRON	CUBE	OCTA-HEDRON	DODECA-HEDRON	ICOSA-HEDRON
Edges	6	12	12	30	30
Faces	4	6	8	12	20
Vertices	4	8	6	20	12
Element	Fire	Earth	Air	Aether	Water

The reciprocal geometric relationship between the icosahedron and dodecahedron (note the number of their respective edges, faces, and vertices) was believed to symbolize the intimate relationship between water and aether. In the Hindu tradition, the icosahedron is associated with *purusha* as a map of the universe, whereas the dodecahedron is ascribed to *akasha* as the equivalent of Plato's aether.

In the material world, water essentially symbolized the perceptible counterpart and mediator of the imperceptible aether, or akasha. Because the material world (represented by the cube) was supposedly manifested from the aether via the mediator of water, it follows that both the icosahedron and dodecahedron are mathematically related to the cube according to the golden ratio. The golden ratio is a so-called irrational number, which was considered by many ancient cultures to serve as the primary mathematical relationship underlying our manifested world. Also known as *phi*, the golden ratio is found

in both Nature and man-made creations (e.g., flora, fauna, music, architecture) and is inherent in all geometries possessing five-fold symmetry (e.g., the dodecahedron and icosahedron).

The intimate relationship between water and aether can also be found in the ancient Hawaiian tradition, wherein the word for water (*wai*) was commonly substituted for that of the etheric or life force (*mana*) when describing its movements in the manifested world.[14] Whether represented by a deity, Element, geometry, or nebulous life-sustaining force, water has been identified in almost every ancient tradition as both a key player in creation and, through its interaction with other forces in the seen and unseen worlds, an animator and principal constituent of worldly forms.

SOMETHING TO REMEMBER

Water's distinctive and bizarre physical properties have puzzled humans for thousands of years. Certainly not the least puzzling of these attributes is the so-called memory of water, which was initially proposed by ancient philosophers and more recently hypothesized by a handful of contemporary scientists and naturalists. What exactly is meant by the term "water's memory?" While there are many ancient references to water and its legendary memory, there appear to be at least two consistent themes. First, the memory applicable to our observable world is either retained within or accessed by water. How water is able to access and/or retain such memory (i.e., the underlying mechanisms and physical processes) is not addressed; however, water is believed either to accumulate memories on its trek through the universe or to access the memory held within a place, field, or dimension that is unrecognized by and unavailable to most humans. Those humans who consistently recognized and availed themselves of this mystical place were labeled as saints or enlightened beings.

The first of water's two roles implies that information is actually stored and carried within the water, whereas the second suggests that water activates or mediates the exchange of information between the observable world and an unobservable storehouse of memory. The unobservable storehouse is an aspect of creation and necessarily affects matter and energy in the observable world, despite our inability to recognize its doing so. Memory storehouses are often described as

etheric or akashic, referring to the aforementioned realm through which matter and life were created via a combination of archetypal forms and fundamental forces. It is from these memory storehouses or universal blueprints (i.e., akashic records) that water purportedly carries or downloads information from the subtle realms of existence into the grosser world we observe with our five senses.

According to New Zealand-based archeologist Barry Brailsford, the ancient Maori word for water, *wai*, also means remembrance or recollection of something that has been. Water is referred to as the memory of all that has ever been and will be. Water's memory is considered to be of the stars and of Spirit, to serve as the spark of life, and to be intimately associated with the process of creation.[15] The Maori apparently understood that water, while traveling through space and time, remembers its journeys among the stars and the compartments of Earth's physical body. Water's ability to recall its travels suggests that it acquires and stores information within its form, rather than just mediates the downloading of information or energy that is stored elsewhere.

Myths that delve into water's memory usually bestow one or the other of these abilities upon water. Besides serving as the storehouse and mediator of universal memory, aether and water were often presumed to function in an analogous fashion (e.g., as a medium within which wave interference patterns arise from continual movement or ceaseless vibration), as is suggested in this metaphorical quotation by Ervin Laszlo.[16]

> *The A-field is a kind of active memory field encompassing space (it is everywhere) and time (it endures). It is as if all the fish and plants in the fish tank were physical manifestations of the water, interconnected by the water in such a way that whatever happens to one influences what happens to all others in a mutually dependent system.*

Stories belonging to a plethora of ancient cultures (e.g., Sumerian, Greek, Egyptian, Celtic) claim that water possesses or symbolizes wisdom. While we may never know exactly how ancient peoples defined wisdom, modern English definitions suggest *the use of knowledge or information to deal correctly or astutely with the world.*

How did ancient people identify water's "dealing" with the world and what might be the source of water's knowledge? The answer to the first part of the question seems to be that water mediates the transition of all manifested forms or, at the very least, all life forms between the seen and unseen realms. For instance, Thales taught that everything entered and exited the physical world through water, and the Bible includes accounts of God's creating the world and giving life from water. The answer to the second part of the question may be that water's knowledge emanates from both the seen and unseen realms, permitting it to access both worldly (material) and heavenly (etheric) information. An example is the ancient Kabalistic interpretation of water's receiving its structure or imprinting from both spiritual forces and earthly forms that lie outside the substance of water itself. Could water really mediate the exchange of forms, information, and energy between the two realms?

A WISE HEALER

Many ancient cultures maintained that the wisdom inherent in water was transferable to humans by virtue of their bathing in or drinking water at specific locations or times. Celtic Europe is probably the most renowned location for sacred springs, rivers, falls, and wells—where humans were purportedly infused with divine wisdom, practical knowledge, and an understanding of the mysteries of life.[17] Water was one of the few vehicles through which ancient peoples believed they could reliably access otherworldly wisdom; hence, these sacred waters often evolved into sites of initiation. By definition, initiation refers to *a ceremony during which a person is accepted into a practice or group* and also to *a new beginning or commemorative passage*. The use of water to commemorate the passage between life and death (i.e., the personal journey to and from Heaven or the unseen world) was so common among ancient peoples that water has subsequently found its way into a number of other religious rituals and ceremonies, such as pre-worship cleansing (Islamic), taking of sacred water (Buddhist), and baptism (Christian).

Ancient Chinese philosophers noted that rivers and streams constitute the blood vessels of Earth. Many Native American tribes also recognized the analogy between the movement of water on Earth's

surface and that of blood in the human body. The gross inorganic chemistry of the planet's seawater and fresh waters are similar—in terms of their major ionic (salt) constituents—to the human body's circulating and cellular fluids (see Table 2B).

TABLE 2B. A comparison of selected inorganic constituents from seawater, extracellular fluids (e.g., blood, lymph), intracellular fluids (i.e., the water in living cells), and typical fresh waters (e.g., rivers, lakes). Values are presented as aqueous concentrations in the units of milligrams per liter (mg/L). About 70% of the solids found in extracellular fluids are suspended molecules such as proteins, which were not considered. Seawater and extracellular fluids share their two most abundant ions (sodium and chloride), whereas intracellular fluids and terrestrial fresh waters share one of their two most abundant ions (bicarbonate). The salinity of bodily fluids is intermediate between that of seawater and typical fresh waters.

IONIC CONSTITUENT	OCEAN WATER	EXTRACELLULAR FLUIDS	INTRACELLULAR FLUIDS	FRESH WATERS
Chloride	19,000	3500	300	8
Sodium	11,000	3200	200	6
Calcium	400	100	0.004	15
Potassium	400	200	6200	2
Bicarbonate	100	1500	600	60
Total Salinity	**~35,000**	**>10,000**	**<10,000**	**<1000**

Whether or not ancient people somehow learned or intuited that both blood and seawater are saltier than noncirculating body fluids (sometimes referred to as *cytoplasm*) is not known—at least to my knowledge; however, a distinction between the water comprising blood and the water collected from lakes or rivers was reportedly made by a number of ancient peoples. Given their understanding of water's role in the body (whichever it may have been), it is not surprising that ancient peoples believed bathing in or drinking the Earth's most pure and sacred waters would necessarily improve the health of their watery bodies. Some of these healing waters were geothermal in origin, accounting for their high temperatures and mineral, or salt, contents. Other healing waters were apparently cold and nearly devoid of salts or minerals.

In fact, only two characteristics of ancient healing waters seem to be consistent among the thousands that have been described. First, sources where water emerged at the ground surface (e.g., streams, springs, seeps) were considered to be sacred and were often as-

sociated with saints or enlightened beings who either discovered the source or whose essence, or spirit, was believed to dwell within the water. Second, the health benefits derived from people's bathing in or drinking the waters were considered predictable and significant.

According to traditions as diverse as Christian, Muslim, Hebrew, Hindu, and Shinto, water's healing and cleansing properties were not limited to the physical body. Water was understood to influence spiritual, emotional, and mental health through processes as diverse as enhancing consciousness, purging evil influences, deepening our connection to Earth, and revealing our place in the world.[18] Ritual bathing and washing were often referred to as *ablutions*, which were reportedly effective in purifying all aspects of a person. Some traditions focused predominantly on the techniques of bathing, whereas others focused on the waters used for bathing (e.g., the Hindu belief that the Ganges River purifies everything it touches). How could one of the world's most polluted rivers actually purify anything that it touches? The answer lies in the controversial belief that the chemical or biological purity of water may not necessarily be a prerequisite for its purifying spiritual, emotional, mental, or even physical health. We will revisit this unusual notion in Chapter 6.

Demonstrating the physical cleansing and healing properties of water was probably quite straightforward; however, documenting the nonphysical healing properties of water seems to have been based on a combination of people's individual experiences (i.e., before and after) and their intuitive knowledge of water's connection to the unseen realms. As was suggested throughout this chapter, ancient and indigenous people's knowing something about the natural world (including water) did not require their intellectual understanding of it, but rather their ability to feel it, sense it, or communicate with it. While it may appear that we postmodern people just do not have the ability to perceive the world as they did and, conversely, that they did not have the ability to perceive the world as we do, this difference may be as much a function of choice and habit as it is of ability.

Similar to postmodern peoples, all ancient peoples had to exploit their available resources in order to survive, and there is evidence of resource overexploitation and waste among ancient peoples from all over the world. For example, anthropologist Shepard Krech posits that the native North Americans' extensive use of fire may have far

exceeded the maintenance of fire-succession ecosystems and their practices of buffalo hunting and fur trading may have been wasteful of some animals.[19] It is almost unimaginable that ancient peoples would not have temporarily overexploited their resources—including water—in order to survive; however, their long-term survival (i.e., that spanning thousands of years) depended upon a predominantly nonintellectual connection to the natural world and its ecosystems for ensuring a sustainable existence.

It is not surprising that most ancient peoples are not considered to have been strict environmentalists or conservationists, which instead describe a subset of postmodern peoples who recognize that we are no longer living sustainably on our planet. Furthermore, ancient peoples' connecting to the natural world was probably not motivated by a desire to be spiritual, but rather by a need to be practical.

SUMMARY

As is the case with all forms of written history, the meaning of symbols, metaphors, and passages are not unequivocal. The intent of the original writer, artist, or storyteller is very difficult to discern due, in large part, to the inherently ambiguous nature of language as a means of describing the world. This is particularly true for the world that lies beyond our five human senses. Moreover, most of written history has been subject to numerous translations, each of which requires a subjective interpretation of the previous translator's words. The challenge is that words and characters from ancient languages often convey multiple meanings, and the context within which they appear does not always discriminate among meanings. Hence, we are left with only our best guesses as to what ancient people were saying to each other and to those who would rediscover their cultures.

3

MODERN: *FOURTEENTH TO NINETEENTH CENTURIES*

Lao-tzu's great contribution to watershed governance was this: Always give priority to water over human special interest. No matter how charming human ideals, poetics, political rhetoric, divine revelations, promises, or factoids, hydrophilia is the best consensus builder.
Peter Warshall[1]

With the dawning of the Renaissance era, so-called modern humans began to look at water in some rather novel ways. While losing little of its mystique as one of Nature's fundamental Elements and a symbol of the primordial chaos from which everything is created, water caught the attention of artists, designers, and philosophers who were intently focused on water's intricate and inspirational movements within rivers, lakes, and oceans. At the same time, an entirely new breed of naturalists began to study the world in terms of its aesthetic attributes that could be quantified using simple mathematical relationships. The path of naturalists (mainly holistic) was more similar to that of ancient peoples (intuitive or experiential) than to the path of the fledgling scientists (mainly reductionist), who would search for the physical basis of water's uniqueness by studying its component particles and processes.

ART AND MAGIC

In addition to its legendary role as a mediator between the seen and unseen realms, the term "living water" has been used throughout history to describe water as an entity that is, itself, alive. Expanding on the ancient theory of Empedocles, a sixteenth-century alchemist and philosopher named Paracelsus hypothesized that each of the four primary Elements consisted of both a subtle principle and a gross corporeal substance.[2] In the case of water, the grosser dense fluid

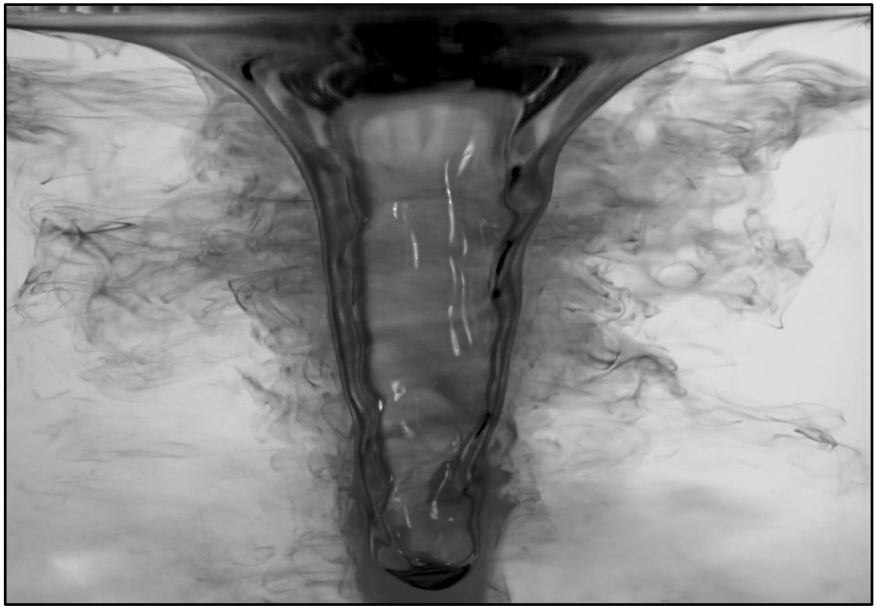
was a constituent of all earthly forms (i.e., animal, vegetable, mineral), while the subtle or fluidic aspect constituted the Element's spirit. According to Paracelsus, the spiritual essence of the four Elements worked in concert with a diverse group of "Nature spirits" called *elementals*, which were composed of the mysterious aether. Because the elementals were etheric, rather than physical, Paracelsus theorized that they could neither be destroyed nor maintain an individual consciousness apart from their physical Element.

Among the elementals, a subgroup called the *undines* were composed of "liquid" aether and were known to work exclusively with the Element of water because their respective vibratory rates were very similar.[3] The undines were considered to be female and to closely resemble the human beings with whom they occasionally interacted. Some of the more famous stories of fairies or "little people" and their relation to sacred waters (e.g., lakes, pools, rivers) are those of the ancient Celtic tradition. The legendary *Menehune* of the pre-Polynesian Hawaiian Islands were also diminutive beings that were believed to have worked extensively with water. Some of the gods and goddesses comprising ancient pantheons may have actually represented these Nature spirits or elementals, which were understood to animate the four Elements. Perhaps this animation is one reason that water was so often perceived as both living and sentient. Not surprisingly, water served as a major component of Renaissance gardens, statues, and designed landscapes.

While many ancient peoples had a mystical and sometimes foreboding view of spirals and vortices, it was the Renaissance sculptors, painters, and naturalists who provided the link between the Middle Ages and our modern perceptions of vortical phenomena. Leonardo da Vinci is probably the best known of the Renaissance artists who was fascinated with water's vortices and other common flow forms, although Agostino Ramelli intently studied water's movements and Leonardo Pisano (better known as the mathematician Fibonacci) applied his theories to all of Nature. Similar to ancient peoples, da Vinci was convinced that water and, in particular, its vortical motion, held the key to understanding and utilizing the power of the universe (see Figure 3-1). While renowned for his paintings and sculptures, da Vinci was also a great student of water and its flow forms, including eddies, currents, and vortices. This great Renaissance artist compiled

hundreds of sketches that illustrate the three-dimensional movement of water through both natural and man-made channels. Based entirely on his understanding of water flow forms, Leonardo da Vinci laid out the design for many types of pumps and water conveyance systems that were developed into full-scale working models by engineers who later discovered his drawings.

FIGURE 3-1. This photo illustrates the spiral movements of water near the axis and at the edges of a vortex. Postmodern naturalists expanded upon the work of artists like Leonardo da Vinci in studying, describing, and interpreting the intricate motions associated with water's flow forms. Naturalists throughout history have noted the rhythm or pulsation of a vortex, which they frequently described as alternating between an extended length with a contracted diameter and a contracted length with an extended diameter. They compared this motion to that of stars in a galaxy or planets around the Sun. Photo by Tom McNemar.



Although most are invisible, vortices are quite common and include phenomena such as whirlpools, eddies, hurricanes, tornadoes, galaxies, and black holes. The diameters of common vortices range from less than a billionth of a centimeter for quantum-scale events to millions of light years for galaxies.

The first recognized unified theory of physics is often attributed to the pre-Renaissance philosophers Leucippus and Democritus, who assumed that the unordered motion of so-called *atoms* is changed to an orderly one in response to a vortex.[4] These men were known as *atomists*, denoting that they somehow understood (perhaps through intuition) the physical world to be composed of tiny indivisible entities that comprise the fundamental Elements and that reside in the void, or space, between the observable components of our world. Both ancient myths and unconventional modern theories maintain that vortices serve as the vehicles for connecting different worlds, whereby vastly different energies encountered in otherwise distinct realms are somehow able to converge their respective vibrations in the space-time phenomenon of a vortex.

EARLY SCIENCE

The Renaissance produced many of the founders of both modern and postmodern sciences, including Galileo, Descartes, and Newton. While Galileo is best known for his contributions to astronomy, he also conducted research in the novel field of fluid mechanics that led to insights regarding the flow of water. René Descartes is best known for his proposed distinction between spirit and matter and for his argument that objective, rather than subjective, knowledge is the most reliable in understanding the natural world. Descartes's views constituted a radical departure from ancient wisdom, which held that spirit and matter (or mind and body) were of the same source and that the intellect and five senses were far too limited to provide a basis for understanding the world. In fact, spiritual masters had long taught that true knowledge was gained through heightened states of consciousness, rather than through the mere analysis of matter. Although controversial at the time, Descartes's philosophies began to cast doubt upon the foundations and validity of ancient explanations for the natural world—including those for water.

The underpinnings of ancient wisdom were further weakened by the tremendous success of Isaac Newton in explaining everything from gravity to motion with his so-called *mechanistic model* of the universe. According to Newton, the universe operated as a machine that could be described by mathematics and understood by a com-

bination of empiricism and deductive reasoning. Toward the end of the Renaissance period, scientists began conducting rudimentary experiments designed to demonstrate that the Elements identified by various ancient cultures (i.e., fire, air, water, earth, metal, wood) could be created from one another and that everything in creation was composed of their differing mixtures. Although Newton based his mechanistic model on atomism, this early empirical science was built upon the widespread ancient understanding of water as one of the fundamental Elements that comprise the material world.

Interestingly, Newton is known to have written extensively on the subjects of theology and alchemy; however, it is not known how these writings may have influenced his novel scientific theories. Given that myth, mysticism, and unconfirmed spiritual experiences were losing credibility as descriptors of the natural world, it is not surprising that the fundamental Elements were as well.

During the seventeenth century, a British scientist and skeptic named Robert Boyle began to question the physical validity of the ancient dogma surrounding the Elements. In doing so, he performed combustion experiments that may have been the first to synthesize water from its two component gases. Boyle's pioneering research paved the way for a succession of eighteenth-century European chemists to experimentally demonstrate that water was probably not fundamental (at least not in a chemical sense), but instead was composed of oxygen and hydrogen gases.[5] This discovery marked the beginning of the great age of water-related scientific research and essentially extricated this common substance from its ancient perceptions, which were henceforth understood to be wrong. This new empirical science convincingly posited that ancient wisdom was a rather poor, or at least a grossly oversimplified, descriptor of water.

The eighteenth-century chemists best known for elucidating the chemical composition of water were Henry Cavendish and Joseph Priestly, the latter of whom also discovered oxygen and its role in the combustion of everything from gases to solids. This monumental discovery effectively eliminated fire as a fundamental Element—at least as far as chemists were concerned. Air, earth, wood, and metal would all meet their respective demises as fundamental Elements at the hands of this new empirical science.

It was the Frenchman Antoine Lavoisier who finally provided a complete description of water's chemical composition and who was able to both form and split water on command. Lavoisier is also credited with the scientific "law" known as the *Conservation of Mass*, which essentially states that only the combinations of atoms—not their numbers (abundance) or masses (weight)—change as a result of chemical reactions. Alas, water could be created from its component atoms! But what exactly were atoms?

ENSUING SCIENCE

Recall that the fifth-century Greek atomists described atoms as undifferentiated, uniform, and indivisible constituents of all matter and, according to some interpretations, forces as well. As previously noted, atoms were believed to be in continual motion as a result of their inherent energy and to interact with one another in a manner that created the physical world. The kinds of atoms (e.g., oxygen, hydrogen, carbon) that were demonstrated by late eighteenth-century chemists to comprise water and other simple compounds do not appear to fit this ancient atomistic definition very well. Nonetheless, nineteenth-century chemists insisted on interpreting the ancient word "atom" in such a way that it could describe their newly discovered constituents of the *Periodic Table* (see Table 3A).

TABLE 3A. Scientists of the modern era attempted to organize the known atoms into a table that grouped together those possessing similar physical properties but different masses. This representation of the Periodic Table is limited to just six of the columns in the first three rows, which include the two atoms comprising water (hydrogen and oxygen) and some of the most abundant atoms in natural waters and biological fluids (sodium, chlorine, silicon, carbon, and nitrogen). The position of an atom within the Table conveys information about the number, type, and configuration of its particles.

	1	14	15	16	17	18
1	Hydrogen					Helium
2	Lithium	Carbon	Nitrogen	Oxygen	Fluorine	Neon
3	Sodium	Silicon	Phosphorus	Sulfur	Chlorine	Argon

The Russian chemist Dmitri Mendeleev, who is credited with assembling the modern Periodic Table, employed the term "element" (referring to the supposedly fundamental particles the observable

world) in describing his arrangement of these modern atoms. Hence, the ancient terms of *atom* and *element* were officially usurped by modern science and henceforth required a clarification as to their context. During approximately the same time period, the ancient practice of alchemy was supplanted by the seemingly more reputable science of chemistry, although the two are actually quite different.

As the Western world moved into the nineteenth century, post-Renaissance scientists understood that water was a simple molecule composed of two very common atoms: hydrogen and oxygen in a 2-to-1 ratio. During this century, numerous and diverse experiments were performed on water in an attempt to explain its bizarre physical and chemical properties—bizarre, at least, compared to seemingly similar substances.

Some of these bizarre properties included water's [1] solid phase, or ice, possessing a density less than its liquid phase, [2] ability to solvate a wide variety of substances, [3] melting and vaporizing at much higher temperatures than anticipated, and [4] tendency to be extremely cohesive—also described as its surface tension. Despite considerable scientific interest in solving the elusive riddle of water's anomalous properties and behavior, scientists' first real glimpse into water's magic would have to wait for the sophisticated investigative technologies of the postmodern era. It is this glimpse that would penetrate the façade of water's simple chemical formula and reveal the ultracomplex nature of its vast molecular network and associated dynamics.

In addition to chemically eliminating water and the other ancient Elements as fundamental constituents of the material world, post-Renaissance scientists succeeded in disposing of the unseen realm from which the Elements were believed to have emerged. The story of the mysterious aether's demise may be summarized as follows. Eighteenth-century physicists were struggling with an explanation for how light waves traveled through outer space, which was considered to be vacuum or void. At that time, the scientific understanding of wave phenomena was limited to mechanical waves (e.g., sound), which required a medium such as air or water for their propagation. The Dutchman Christiaan Huygens therefore reasoned that there must be a gaseous substance permeating the interstellar vacuum and decided to refer to it as the *luminiferous aether*. Physicists subsequently

learned that light waves, quite unlike sound and other mechanical waves, were electromagnetic and apparently required no medium for their propagation. At the end of the nineteenth century, the famous Michelson-Morley experiment indicated that there was no apparent "wind" resulting from Earth's movement through outer space and, consequently, the luminiferous aether did not exist.

So, within a timeframe of about 300 years, modern science had succeeded in eliminating both the aether and the fundamental Elements, which had been integral to most ancient understandings of the world for at least the previous six millennia. However, there is still considerable ambiguity as to what exactly was eliminated. Any correlation between Huygen's luminiferous aether and typical ancient descriptions of aether appears to be tenuous. Luminiferous aether was supposedly a gas or gas-like substance found exclusively beyond Earth's atmosphere, whereas ancient descriptions of aether neither limit it to outer space nor specify that it consists of ordinary matter (i.e., a gas). On the contrary, most translations suggest that the ancient aether was not of the gross or observable world and, while sometimes referred to as a substance, was also identified as a force, energy, field, and dimension. The nature of this ancient aether remains a mystery; however, recent scientific data suggest that our universe consists of considerably more than the forces and particles currently described, prompting some scientists to revisit the ancient aether under a variety of new names (e.g., the A-field).

The ancient Elements are certainly not fundamental in a physical sense, but then neither are atoms nor protons nor quarks—all the "basic" particles simply represent patterns of energy. These are the organic patterns that create the diversity of the material world and are characterized by Taoism as infinite in both number and scale. Although sometimes interpreted as symbols of currently recognized forces and states of matter (see Table 3B), the Elements are believed by some historians to represent more than just gross aspects of the manifested plane and, instead, to symbolize universal principles or intelligence.[6] As such, the Elements are routinely linked to particles, forces, and mysterious energies that are believed to animate the manifested world. Other historians maintain that, whereas the two minor Elements (air as space and earth as matter) may have been used primarily as symbols, the two major Elements (fire as energy and

water as the chaos) seem to have been used as much in a literal as in a symbolic manner.

TABLE 3B: The four fundamental Elements and aether have been used to represent seen and unseen aspects of the world. The common symbols are those interpreted from ancient traditions, whereas the metaphoric roles have their roots in modern and ancient perceptions. In addition to the three most common states of matter (solid, liquid, and gaseous), science recognizes matter consisting of charged atomic particles (plasma) and of a completely unknown composition that affects universal expansion (dark). The recognized forces of postmodern physics have been progressively narrowed to include electromagnetism, the atomic nucleus, and gravity. Whereas the former two have been or will soon be unified into a single theory, the addition of gravity has proven problematic inasmuch as it requires the presence of additional, but as yet unobservable, spatial dimensions in our universe.

	FIRE	EARTH	AIR	WATER	AETHER
Common symbols	Energy	Matter	Space	The Chaos	Heaven
States of matter	Plasma	Solid	Gaseous	Liquid	Dark
Metaphoric roles	Transform	Nurture	Refine	Mediate	Create
Forces of physics	Electro-magnetism	Strong Nuclear	Weak Nuclear	Gravity	None (A-field*)

** The A-field is one of omnipresent information and does not correspond to any of the currently recognized forces of physics.*

Water is the only ancient Element (including metal and wood) that is recognized by modern chemistry as a single, or unique, substance on the molecular scale. All of the other Elements have been identified as either nonspecific substances or mixtures of molecules. Is water's distinction from the other fundamental Elements a mere coincidence—or not?

SPIRITUAL SHIFTS

The combination of Newton and Descartes gave credibility to a world that was inherently mechanical, logically understandable, and readily transparent through observation and empiricism. There was no need to invoke God in manifesting or sustaining the physical world and, in any case, there was no way of proving or disproving the existence of such a deity. Whereas this particular Renaissance world-

view indirectly contradicted the wisdom of most ancient traditions; it directly contradicted the religious dogma of the day. Considering the tremendous influence of Western religions (particularly Catholicism) during the modern era, early scientists were literally endangering their lives by proposing these theories. Major spiritual and religious shifts that occurred during the modern era were responsible, in large part, for transferring most people's perceptions and understandings of both water and the natural world from the domain of the religious to that of the secular.

Over an even longer period than was required for science to supplant ancient wisdom as the predominant modality for understanding both water and the natural world, an equally monumental shift was occurring in the spiritual, or at least within the religious, realm. It is generally recognized that most ancient spiritual traditions were built upon a reverence for the physical world, including the Earth and the numerous components of "her" planetary body (e.g., animals, plants, water, rocks). Not only did many of these ancient spiritual traditions place enormous import on recognizing, respecting, and thanking these earthly components (often portrayed as both sentient and communicative), but also they encouraged people to commune with and experience their own personal connection to these fellow aspects of creation. There was far more emphasis on experiencing water than on learning about it. How might one's experiencing a connection to the natural world differ from one's deducing a connection to it? According to most ancient traditions, humans were neither more nor less important than was any other aspect of the universal whole.

By contrast, many of Western religion's tenets are cited (correctly or incorrectly) as contradicting the fundamental aspects of ancient spirituality. Mythologist and historian Joseph Campbell suggested that ancient spirituality focused on aligning people with their own human nature and the natural world, while modern Western religions advocate subduing one's human nature and controlling the natural world.[7] In the former, man is perceived as only one aspect of an integrated world. In the latter, man is perceived as separate from and dominant over a segregated world. Campbell suspected that differences between the nature-oriented and human-oriented spiritual systems may have developed out of agrarian and nomadic lifestyles, respectively. Whatever the genesis of the two systems, such radically

different worldviews are plainly evident from people's actions toward and decisions regarding water.

It was the naturalists, rather than the theologians, who served as the keepers of ancient wisdom and spokespersons for the natural world during the modern era. Historian Thomas Berry notes that many Western religions of this period deemphasized the creative principles of Nature, which were embraced first by naturalists and later by scientists, in order to focus on the redemptive healing of an earthly world that was perceived to be flawed.[8] Given the collective changes in modern people's perception of the natural world and the concurrent shifts in the underlying message of most contemporary religions, how was the ancient view of water altered during and after the Renaissance era? While the answers are many and varied, the net change in perception seems to have been from one of reverence for water to one of dominance over water.

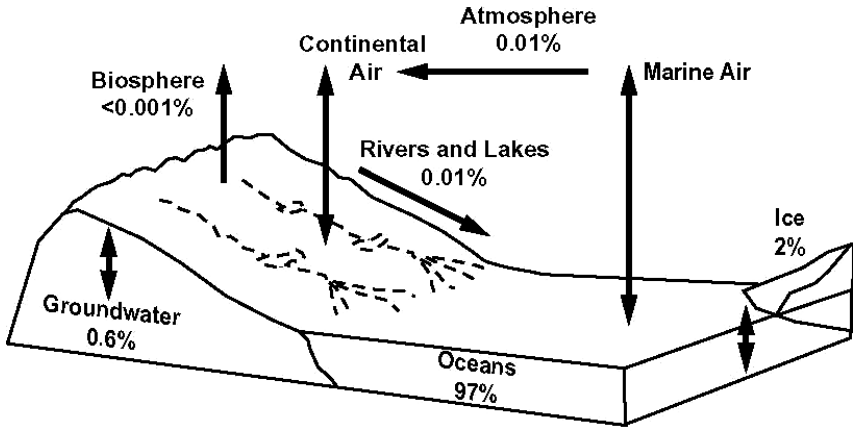
Whereas humans have always used water, the attitudes and beliefs accompanying that usage have varied dramatically. Some historians suggest that the insights of modern naturalists have preserved the remaining vestiges of our experiential and intuitional links to water, whereas the various ceremonies practiced in Western religions (e.g., baptism) have retained what is left of our spiritual link to water. Just as modern people may have substituted their personal experience of water for scientific explanations, they may have also substituted their personal kinship and spiritual connection to water for the ceremonies that were meant to honor that kinship and connection.

A MECHANICAL WORLD

Although initially considered more philosophy than science, the first Western theory of hydrology appeared in the mid-seventeenth-century (Eastern theories of hydrology appeared centuries earlier—much to the astonishment of Westerners) when Pierre Le Petit constructed a viable water balance for a section of Seine River drainage.[9] Subsequently, scientists invoked the diverse processes of evaporation, precipitation, transpiration, infiltration, and groundwater discharge to build mechanistic models illustrating how water was continuously cycled through different planetary compartments, including the soils, oceans, atmosphere, continental waters, and biological organisms.

This modern hydrologic model replaced the ancient one—often attributed to our old friend Thales—that maintained water was produced deep within the planet, where it eventually found its way to surface springs and other water bodies. The ancient subterranean sea or river was henceforth interpreted as a metaphor for the "waters of chaos," rather than as a literal source of planetary water. This altered perception of the hydrologic cycle (see Figure 3-2) served as a crucial foundation for water technologies developed during the modern era.

FIGURE 3-2. This simplified conceptual model of Earth's hydrologic cycle shows the fraction of planetary water comprising each environmental compartment, which is presented as a percentage of the total water cycling through the system. Arrows indicate the major routes of water exchange among the various compartments; two-headed arrows indicate that water moves in both directions. According to the modern hydrologic regime, most of Earth's water has been here since its formation, and the total volume of surface water has changed only slightly (e.g., due to large comet hits early in the planet's history) over the last 4.5 billion years. While the assumptions underlying the modern hydrologic regime continue to be challenged and refined, there is no question that water's global scale phase changes (e.g., solid to liquid to vapor) represent the primary mechanism by which solar radiation is converted into the energy that drives most planetary systems. The ultimate source of all freshwater is the oceans, where solar heating of seawater results in the evaporation that creates the clouds and sustains the winds for delivering global precipitation. Reprinted from *Universal Water*.[10]



A number of ancient cultures (e.g., Roman, Indian, Egyptian) built stone and wood aqueduct systems to carry water, via gravity flow, from upland sources to population centers within the same or adjacent watersheds. Most of these ancient systems were abandoned

in the Middle Ages, requiring new systems to be designed and constructed throughout the modern era. The initial water systems of the Renaissance period were similar to small-scale ancient systems in minimizing disruptions to water's natural cycles and flow regimes; however, the eventual introduction of new building materials and various mechanical pumps permitted more water to be transported farther from the source.

By the end of the nineteenth century, the industrialized world was well on its way to damming rivers, using waterfalls and diverted streams to generate power, and pumping water over long distances. The first dams were relatively small and altered the natural, or seasonal, flow of small rivers and streams only slightly. Less than three decades later, humans would develop the means to completely alter the natural flow regimes of major rivers.

Another transformation attributed to the Renaissance era was a marked increase in both trade and commerce, especially along the Mediterranean Sea and the navigable rivers of Europe. Money from this trade boom was available to create a banking industry that could lend money to churches, states, and commercial enterprises, as well as to finance large construction projects. These innovative banks, which were owned and operated by some of the wealthiest European families, are recognized as financing the Renaissance movement.

Whereas the capital for building and operating water projects was not repaid specifically as water use fees, it was repaid in the form of taxes collected by states or landowners. Generally, people were not charged for water because, based on European common law, access to usable water was considered to be a right of every person. In fact, most rural people had little or no exposure to commerce and simply collected their water from nearby sources.[11] The modern view of a water "right" is believed to have originated with ancient traditions, whereby the natural world and its so-called *common resources* (e.g., water, air, land, seas) constituted a gift from Earth, God, or specific deities that was to be shared among all planetary inhabitants.

Servicing the needs of population centers located far from productive sources required water to be transported, stored, and then distributed on demand. The negative consequences of such large-scale manipulations probably constituted the first of many warnings about interfering with water's natural processes. Essentially, water

collected from relatively pristine natural sources is constantly purified and balanced via a wide range of physical, chemical, and biological processes that were unrecognized at the time. As water was transported to and stored within urban environments, it acquired toxins from various man-made conduits and microbes from human wastes. Because these unwanted additions could not be readily detected in water, they resulted in countless epidemics and untold deaths during the Renaissance and post-Renaissance periods.

It was well into the nineteenth century before scientists such as Louis Pasteur hypothesized that water-borne microbes and insect vectors were the causes of such catastrophic plagues—some of which persist even today. Despite the broader implications of these discoveries, natural waters remained the preferred disposal sites for wastes generated by an increasingly industrialized modern world. Modern wastes would prove to be very unlike the wastes produced by ancient humans; hence, their eventual effects on water and the entire natural world were largely unforeseen.

In concluding this section, it is worth noting that while modern scientific theories and modern religious beliefs conflicted on specific issues, their basic underlying attitudes toward the natural world were amazingly complementary. The combination of scientific empiricism and religious anthropocentrism was also effective in creating the now-prevalent perception of separation, whether man from animals, animals from plants, living organisms from nonliving rocks and water, spirit from form, form from substance, myth from reality, intuition from knowledge, experience from observation, or the perfection of Heaven from the imperfection of Earth.

In my opinion, many of the challenges we now face with water and the entire natural world may be traced not to a handful of ideological conflicts between science and religion, but rather to numerous shared and heretofore novel ways of perceiving Nature and the place of humans within it. Moreover, a rapidly expanding economic and scientific interest in the natural world (as a resource repository and global laboratory, respectively) during the modern era proved to be a far cry from the intimate connection to and heartfelt appreciation of Nature described by many ancient and indigenous peoples.

SUMMARY

Building upon the portrayal of water as pantheistic characters, modern humans began to incorporate their intuitive or experiential relationship to water into a more intellectual and, from a modern perspective, comprehensible format that constituted philosophies and religions. These philosophies often echoed the message of ancient myths, but they also began to explain water's mysteries in a more pragmatic manner and to define its relationship to other aspects of the physical world. Not only was water being defined in the physical world, but it also was being classified on the basis of the functions that it was believed to perform. The sacred living water of ancient cultures was now confined to ceremonial surrogates such as holy water, and eventually the relationship between the two was largely forgotten—relegating living water to an antiquated and scientifically incorrect myth. By the end of the modern era, the Western world was well on its way to perceiving water as a scientific curiosity and a natural commodity, rather than as a sacred mediator and a spiritual symbol of the Absolute.

"Water is H_2O, hydrogen two parts, oxygen one, but there is also a third thing that makes water and nobody knows what that is."
D.H. Lawrence, *Pansies*

4

POSTMODERN: *TWENTIETH AND TWENTY-FIRST CENTURIES*

"The belief that science will provide us with all the answers of physical existence is slowly but surely being replaced with the belief that science will perhaps help lead us to the spiritual source of our existence. The world of human thought and belief is once again returning to the search for the spiritual within nature."
William Marks[1]

The postmodern era heralded the most rapid and far-reaching transformations that perhaps had ever been witnessed by humans. Water was about to be subjected to changes so radical and immense that they would alter the spin of the Earth, the global distribution of rainfall, and the stability of the ground beneath our feet. We would learn that water is not unique to this planet, but instead is ubiquitous throughout the universe in at least one of its three states (solid, liquid, or vapor). This is a period during which our scientific knowledge has progressed so quickly that today's molecular description of water would have been nearly incomprehensible to physical chemists at the beginning of the twentieth century.

This was also an era in which the heretofore novel combination of unchecked industrialization, worldwide resource exploitation, and insatiable consumerism would lead the Western world into an era of financial wealth, spiritual ambiguity, and environmental disaster. As arguably the most critical substance on this planet, water would act to mirror—in more ways than we could have imagined—our trek into the new millennium. While this chapter introduces some of our major postmodern perceptions of water, the remainder of the book examines in greater detail these perceptions and our opportunity for altering them.

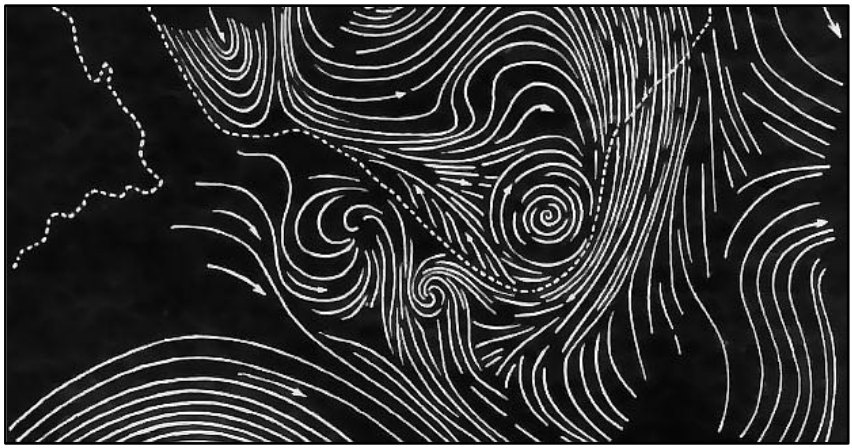
CONTEMPORARY NATURALISM

Five hundred years after Leonardo da Vinci accurately sketched the three-dimensional movements of water, postmodern naturalists are still describing water's intricate flow forms and its mediation between the seen and unseen worlds. They write of water's wisdom, memory, and versatility, as well as its mediation between both Sun and Earth and material and nonmaterial worlds. While certainly not science by modern standards, this type of naturalism is generally viewed as a contemporary cross between the enduring metaphors of ancient myth and the evolving explanations of postmodern science. At the beginning of the twenty-first century, this type of naturalism has been almost completely eclipsed by the only modalities that many of us postmodern Westerners have ever known for understanding and describing water—namely, the natural sciences and a burgeoning number of socio-political institutions (e.g., financial, governmental, legal).

A mid-twentieth-century German naturalist named Theodor Schwenk theorized that water acts as the mediator between the creational forces and physical manifestations of the universe via its rhythmic waves, ripples, whirlpools, and other flow forms. He often described water as the mediator between ordinary matter and energy, as well as between the etheric and observable realms of the universe. Some of the more frequently postulated relationships between water and the etheric, or akashic, realm are discussed in the first section of the Appendix.

As a mediator, water was considered by Schwenk to be the ideal medium for form-creating processes because its many and varied rhythms permit the merging of energies at boundaries, such as those created at the interface of ocean currents or cell membranes (see Figure 4-1). He proclaimed that no material change could ever occur in Nature without water.[3] Whereas contemporary scientists do not subscribe to Schwenk's poetic and grandiose descriptions of water, they recognize that water actually does mediate a substantial number of worldly events, as will be described in the next section.

FIGURE 4-1. The formation of global scale vortices occurs where ocean waters of differing temperatures and/or salinities abut. Oceanic vortices are created by everything from the direction of Earth's rotation to the heat of seafloor vents. Many small vortices may combine to create a larger one or a large vortex may split into many smaller ones. Oceanic vortices can reach diameters of 10,000 kilometers or more and remain stationary or move around entire ocean basins. Electromagnetic energy is created at the interface of these gigantic seawater masses, which are routinely monitored by oceanographers. Theodor Schwenk believed that these oceanic interfaces permitted vortices of different rhythms to merge and, thus, to mediate the transfer of energy and information. Reprinted from *Sensitive Chaos*.[2]



Similar to artist Leonardo da Vinci, Viktor Schauberger—a post-modern Austrian naturalist—maintained that vortices and their motions were responsible for the creation of forms. An alternation of vortical motion between centripetal and centrifugal modes was believed to represent the inhalation and exhalation, respectively, of creative energy.[4] The former represents a creation or an ordered movement from the unseen realm, whereas the latter represents an apparent destruction or a return to the unseen realm. Schauberger's dichotomy also restates the biblical notion that God breathes life into and out of matter as a consequence of His balancing the universe between chaos and order. Further, his statement introduces us to the controversial but curiously persistent insight that vortices possess a rhythm that alternates between two opposite polarities or states, permitting a vortex to link the seen and unseen realms.

Another mid-twentieth-century naturalist, Johann Grander, reiterated the basic tenets of ancient views in suggesting that water both mediates the flow of stored information from the seen to the

unseen world and activates the memory stored in matter belonging to the material world (e.g., DNA). As such, water acts as an activator of creational or life-giving energy that operates primarily through the mechanism of rhythm or sympathetic vibration. In other words, all life-sustaining information is downloaded to the appropriate physical forms as a result of water's transposing or transducing vibrations of vastly different frequencies.

Storehouses of memory have been attributed to everything from so-called *morphic fields* (i.e., those proposed by biologist Rupert Sheldrake to influence the form of all matter) to other spatial dimensions (e.g., those proposed by theoretical physicists to exist beyond the observational limits of our four-dimensional world). Theoretically, information could be coded within and accessed from such memory storehouses; however, neither their whereabouts nor the underlying mechanisms involved in storing and retrieving information have been demonstrated.

MEMORY AND MEDIATION

Although occasionally appearing in the scientific literature, the topic of water's memory is definitely not one that appeals to many contemporary scientists. The best known of these appearances involves a process known as *homeopathy*, whereby a dissolved substance (known as a *solute*) is added to water and then sequentially diluted to the point that none should be present in the final solution. The final solution reportedly affects living cells more strongly than does the initial solution. The proposed mechanism for homeopathy involves the formation of water clusters that initially solvate, or envelop, the substance and that supposedly persist for long periods even after the substance is gone. The major argument against such a mechanism is that the lifetime of liquid water clusters (absent a solute) is a fraction of a second. Recent theories suggest that water clusters associated with certain solutes (e.g., dissolved gases such as carbon dioxide or oxygen) may be preserved for as long as a single day; however, the applicability of this cluster preservation to water's reported long-term memory is unknown.

Another type of memory has been described for seawater, which is able to both affect and record Earth's climate history in the form

of subtle temperature differences that are transported worldwide via the oceanic circulation system. The proposed climate memory certainly qualifies as long term, although its application to homeopathy or to activating DNA codes seems to be limited. Whereas memory has been relegated to the periphery of contemporary science, late-twentieth-century research emerging from scientific disciplines as diverse as astronomy, climatology, molecular biology, and physical chemistry suggests that water plays diverse mediation roles within our known universe.

We now know that water serves as an essential functioning component of biological macromolecules (e.g., DNA, proteins), a major player in all cellular processes (e.g., transport, communication), the primary mediator between solar cycles and earthly climate regimes, and a key component in birthing stars from galactic dust and gas clouds. Even the energy required to build, to sustain, and to recycle biological and many geological structures is facilitated, or mediated, by water's unique physical properties. Water's recognized mediation roles include:

- **The structuring and functioning of biomolecules, such as DNA.** A special form of water actually serves as a component of these biomolecules, which depend on large assemblages of water molecules (*hydration envelopes*) to achieve the three-dimensional geometry representing their bioactive form. At least some of biology's life-sustaining information is passed through the intermediary of water. The splitting and forming of water molecules underlie biology's energetics within complex processes as photosynthesis and respiration. Life is really more water-based than it is carbon-based.

- **The major controller of climate regimes and weather patterns through its cycling among oceans, clouds, soils, and atmosphere.** In this role, water mediates the redistribution and transformation of incoming solar energy over the planet's surface. Besides affecting short-term weather patterns, water may facilitate long-term climate changes and is sometimes referred to as the mediator of rapid climate change. Water is also instrumental in electrically connecting the planet's surface to the upper atmosphere, where Earth is subjected

to powerful solar influences. Even subterranean nuclear reactions and the cycling of rock from the solid crust to the underlying molten mantle are facilitated by water.

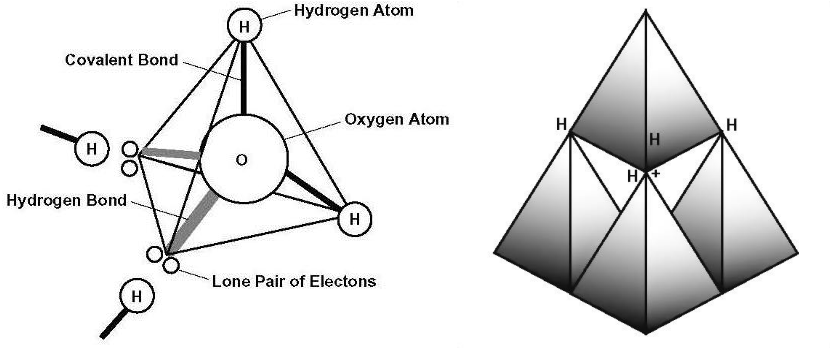
- **One of the most abundant molecules in the cosmos.** Water influences phenomena as diverse as the opacity of stars and behavior of comets to the topography of moons and formation of galaxies. A rare type of water ice has been identified as the cosmic glue that creates planets from interstellar dust particles, whereas water vapor apparently acts as a kind of midwife in assisting with the birth of stars from the interstellar clouds scattered throughout our galaxy. In doing so, water itself is created via shock waves emanating from the star's formation. Much of Earth's water may have been used to birth our Sun, which will eventually die and, in doing so, release the atoms that comprise our universe.

NETWORK BEHAVIORS

Perhaps the late twentieth century's most startling discovery about liquid water was that it consists of a vast interconnected network, rather than just a random collection of agitated molecules. Individual water molecules serve as the network's *components*, which constitute the building blocks for the primary, or fundamental, water network. These components of water's molecular network are connected to one another via magnetic-type linkages known as *hydrogen bonds*. The network is characterized as highly dynamic inasmuch as the linkages between components are constantly exchanged.

In solid water, or ice, each water molecule bonds with all four of its nearest neighbors in forming a perfect tetrahedron, which is a three-sided pyramid comprising the most basic molecular geometry of water (see Figure 4-2) and, perhaps, the most basic structure of the universe. Itzhak Bentov suggested that the tetrahedron's geometry and associated mathematics, which were briefly described in Chapter 2, apply to the sacred Trinities that have been identified throughout human history (e.g., Brahma-Vishnu-Shiva) and to the *fine structure constant* (mathematically defined as 1/137 or 0.00729735. . .) that characterizes the interaction among charged particles comprising the structure and displaying the patterns of all matter.[5]

FIGURE 4-2. The schematic on the left represents the simplest unit of water's hydrogen bonded network. The large oxygen atom serves as the center vertex of a tetrahedron, while the smaller hydrogen atoms serve as its four outer vertices. Two of the hydrogen atoms are covalently bonded to the oxygen atom, comprising the individual water molecule (H_2O). Water molecules are hydrogen-bonded to each other via two pairs of electrons associated with each oxygen atom. These electron pairs attract two hydrogen atoms (each donated by a different neighboring water molecule) in forming a tetrahedron composed of one oxygen atom and four hydrogen atoms. Covalent bonds (thick black lines) create a water molecule by linking atoms together, whereas hydrogen bonds (thick gray lines) create a water network by linking molecules together. The schematic on the right is composed of four hydrogen-bonded water molecules. Linking water molecules together via different geometric arrangements creates a wide variety of water clusters. Reprinted from *Universal Water*.[6]



As ice melts into liquid water, 10% to 15% of the bonds connecting neighboring water molecules are broken at any instant (thus distorting the tetrahedron), while the remaining bonds transition to an ultra-dynamic state whereby they switch as rapidly as a trillion times per second! Hydrogen bonds are broken only for an instant, permitting water molecules the opportunity to alter their orientation to one another. This frantic switching of linkages permits the water network to flow and to behave as a liquid even though it retains most of the molecular geometry of a solid. Nobel laureate and chemist Linus Pauling reportedly referred to this conservation of hydrogen bonds and network geometry as water's remembering its past while it transitions from a solid to a liquid.[7]

While water's ever-changing molecular network may not sound magical, its dynamics are believed to be responsible for most of its unusual properties. Moreover, the resistance of liquid water to alter its "ice-like" network may permit it to display a very unusual and highly controversial kind of cognition. *Systems theorists* working in

many different fields have postulated that relatively simple dynamic networks can account for a wide range of complex behaviors. They maintain that interconnected components express so-called cognitive properties (e.g., varying responses to differing stimuli), which emerge from a set of rules for switching network connections—even if those rules are applied at an arbitrary initial state.[8] In other words, the complex adaptive behaviors of an entire system (i.e., any entity composed of many similar components) may simply relate to the way in which connections between individual components are switched or exchanged among each other (see Table 4A). Could water's memory be traced to a network that exchanges connections (hydrogen bonds) between its components (water molecules)?

TABLE 4A. Hydrogen bond dynamics for various physical states and locations of water are contrasted with the vibrations of covalent bonds that hold an individual water molecule together. Hydrogen bond dynamics span a factor of about one quintillion and are presented in the rhythmic units of "beats per second," which correspond to the frequency of exchanges. The vibrational range and quantum-scale origins of water's network have led some theorists to posit that it mediates between different forms of matter, between matter and energy, and between the observable and unobservable realms.

LOCATION OR STATE OF WATER MOLECULES	APPROXIMATE TIME BETWEEN HYDROGEN BOND EXCHANGES	RHYTHM (beats per second)
Gas-liquid interfaces	hours to one day	thousandths
Crystalline ices	minutes to hours	hundredths
Biomolecules	thousandths of a second	thousands
Hydration envelopes	Billionths to millionths of a second	millions to billions
Bulk liquid	trillionths of a second	trillions
Covalent bonds		**quadrillions**

Postmodern scientists have long modeled liquid water as a space-filling network of individual water molecules in which all potential hydrogen bonds are characterized as either unbroken or broken.[9,10] Unfortunately, the shuffling (i.e., breaking and forming) of hydrogen bonds within water's network is so rapid and complex that scientists are unable to decipher the rules governing the process. This inability does not imply that the switching rules are haphazard—only that science is overwhelmed by water's dynamism, which has been traced to quantum events known as *zero-point vibrations*. These vibrations govern the exchange of water's hydrogen bonds and are impossible to predict as a result of the uncertainty inherent in quantum-scale

events. Unlike the dynamics of more common chemical bonds (e.g., the vibrations of water's covalent bonds) that are governed by the familiar laws of motion and heat, the dynamics of water's hydrogen bonds are propelled by an unknown energy from empty space that persists even at a temperature of absolute zero.[11] Emanating beyond the most fundamental level of Nature's hierarchy that scientists can currently observe, water's network dynamics appear truly etheric.

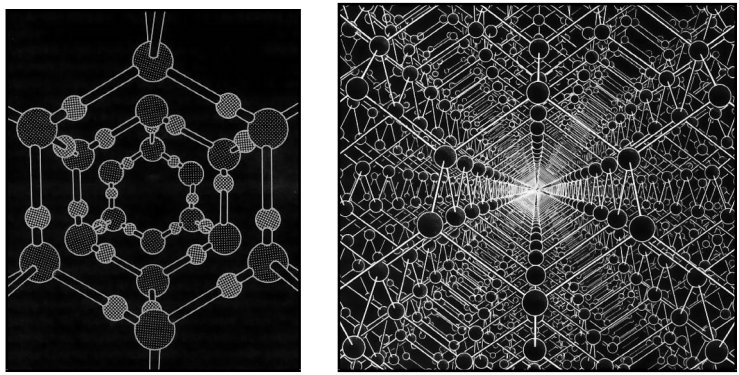
Do any other networks—besides the one comprising individual molecules—exist in liquid water? The answer is not known. It has been suggested that water clusters (e.g., hydrogen-bonded groups or assemblages of molecules) may represent the individual components of a secondary water network; however, the degree of connectedness among clusters has not been demonstrated. There are a few aqueous solutions (e.g., seawater) within which individual water clusters are positioned sufficiently close to each other to share one or more water molecules. Theoretically, these shared water molecules could link adjacent clusters, serving as the components of a secondary network.

BETWEEN ORDER AND CHAOS

Water's ubiquitous presence and uncanny gift of transforming energy permit it to mediate myriad planetary and cosmic events, whereas its ability to transmit and perhaps even "rhythmically merge" energies is a consequence of the way in which individual molecules self-organize, or arrange themselves, into the aforementioned networks. Researchers who work at the fringes of postmodern science maintain that water's vast and ever-changing network may serve as a kind of massive information system—not unlike the binary systems that characterize today's computers. While there are no scientifically accepted data to confirm such hypotheses, much of water's magic remains cloaked behind the dynamics of its currently undecipherable network. In other words, however simple the components of water may appear, their collective dynamics are enigmatically complex. Most of what is hypothesized about water's vast networks has been extrapolated from brief glimpses and then mathematically modeled to produce a more complete description (see Figure 4-3). Essentially, water consists of a three-dimensional tetrahedral lattice that is con-

figured so that its concentric coordination spheres form the template for a variety of sacred geometries (e.g., the Flower of Life).[12]

FIGURE 4-3. This schematic is believed to resemble the network structure of liquid water; however, scientists have been able to observe only a fraction of the network using current technologies. In view **A**, the large dark spheres representing oxygen atoms are connected to the smaller and lighter-shaded spheres representing hydrogen atoms. Hydrogen atoms are situated along the connecting hydrogen bonds. Water's hydrogen-bonded network is difficult to depict at the scale of view **B**; nonetheless, note the seemingly infinite matrix that exists among individual water molecules as hydrogen bonds (white lines) intersect oxygen atoms (black spheres). The network's structural complexity, along with its hydrogen bond dynamics, may ultimately prove to be the key to water's magic. Reprinted from *Perspectives on Biogeochemistry*.[13]



A **B**

An interesting analogy exists between water's network and a theme of many ancient creational myths—namely, that ordered or structured forms are created from chaotic or unstructured sources. In the case of liquid water' network, the bulk fraction is characterized as unstructured because connections, or bonds, between its adjacent water molecules are frenetically and unpredictably switched. Oddly enough, highly ordered clusters of water molecules are produced from this bulk fraction by arranging themselves into predictable three-dimensional structures that switch their respective connections at a more leisurely pace. Hence, ordered water clusters are ultimately produced from a seemingly chaotic sea of bulk water molecules.

The analogy between the creational medium and water (in terms of a chaos-order dichotomy) is even more curious in light of modern, although highly controversial, contentions that water's clustered or structured components are responsible for its designation as "living."

Recall that living water was the label given to the substance that was understood by ancient peoples to serve as a creational mediator between the seen and unseen realms. Hence, the presumed mediator of creation (water) displays within its complex networks a balance between order (as its clusters) and chaos (as its bulk fraction). There is considerable scientific debate as to whether water-only clusters (absent any solute) are distinct entities or just idealized molecular groupings inferred from the ceaseless switching of bonds among the components of water's network. Furthermore, any relationship between clustered living waters and sacred living waters, which were believed by ancient peoples to mediate between the seen and unseen worlds, remains ambiguous.

Interestingly, the results from computer simulations have suggested that liquid water's molecular network may exhibit two very distinct types of behaviors—ordered and chaotic—successively or simultaneously. Water's ability to display both ordered and chaotic behaviors is a result of its network containing both clusters (highly structured assemblages) and a bulk form (less structured or ever-changing assemblages). Theorists maintain that the true complexity of any system arises between the states of order and chaos, which really represent two very different types of order.

Furthermore, the rapid switching of a substance between ordered and disordered states or between crystalline and amorphous phases can actually function to store and retrieve memory. Even the positioning of atoms within water's molecular network is chaotic, such that hydrogen atoms oscillate between one of two orientations—not unlike the components of other types of networks that have been used to transmit binary codes. Whereas complexity theory has yet to attain the status of a natural science, it does suggest that complex systems tend to position themselves between order and chaos.[14]

POLICY AND POLITICS

It is frequently argued that the relationship between postmodern humans and water is only peripherally unrelated to its governing laws, regulations, technologies, or management plans. These rules and applications simply reflect our collective perception of water. In other words, our challenges with water arise primarily out of our underlying

perception of water and only secondarily out of the institutions that reinforce such a perception. For instance, water is routinely bought, sold, stored, and distributed as a commodity because that is exactly how we perceive water. So, why are so many people outraged by the prospect of the planet's water resources being privately owned and dispensed according to the highest financial gain (as are many other natural resources)? The answer seems to be that water constitutes a natural resource quite unlike most others. Why so? Well, many people feel that water is just simply different. Similar to air and sunlight, access to water is considered by many postmodern Westerners to constitute a kind of birthright. In other words, access to clean, safe, and affordable water is a privilege derived from our being born on Earth.

How exactly did water come to be viewed as a right and a commodity in today's world? The answer may be found in practices that were initiated during the modern era and institutionalized during the postmodern era. By contrast, most ancient and indigenous cultures considered water to be a sacred gift from the gods or the Earth that was to be shared among all inhabitants. Everyone's right to access and utilize the gift of water was represented by common law, which permitted landowners to use the water on or flowing past their land. In contrast to most ancient precedents, the modern use of water was recognized only for human beings and was inextricably linked to land ownership.

Moving into the postmodern era, the right to use water evolved into a legal entity known as a *water right*, which could be traded or sold separately from the land. This new legal right represented an important step in people's perceiving water as a commodity. By the mid-twentieth century, water was transformed from an ancient gift that was bestowed upon all earthly inhabitants to an inherent right, or privilege, that was owed humans alone.

During the latter part of the twentieth century, three additional shifts in the collective perception of Westerners paved the way for corporations to begin acquiring water resources and dispensing them at the highest price. The first shift is that ordinary tap water was considered to be of questionable quality due to its frequent pollution at the source and its treatment with chlorine and other additives. The second is that governmental and collectively owned utilities, which

had historically dispensed water in the public interest and allegedly managed water resources for both environmental integrity and non-human users, were increasingly viewed as either incompetent or ill equipped. The third is that global water resources were apparently dwindling and, thus, were believed soon to be in short supply. This combination initially spawned the bottled water industry and eventually permitted transnational corporations to begin acquiring water rights, distributorships, and infrastructure.

As we move into the twenty-first century, the battle lines are clearly drawn between those who believe that the capital and efficiency of the private sector are required to address the worldwide water crises and those who believe that a private sector cartel will ultimately deny water to those who cannot pay—including the natural environment and nonhuman users. In lieu of dissecting the two arguments, let's take a look at some perceptions of water that appear to be shared by both camps.

First and foremost, water is no longer considered as a gift for which to be thankful, but instead as either a right to be demanded or a commodity to be supplied. Second, water has been figuratively relocated from its natural arena into the anthropogenic arenas of law and politics, where its continued perception as a financial commodity and legal entity is assured—regardless of who wins. Finally, the debate focuses exclusively on a usable freshwater resource, such that the other 99% of the planet's water (i.e., the seawater and inaccessible freshwater that serve as sources for our usable resource) is largely ignored. This myopic focus on the usable water resource, rather than on all planetary water, is a remnant of the modern era.

As one of the postmodern era's most prominent authorities on global water resources, Peter Gleick recently distinguished between *soft* and *hard* paths in humanity's effort to meet the challenges of our current water crises.[15] He views the hard path as the continued reliance on centralized infrastructure to capture, treat, and deliver water supplies—often incurring both ecological and social disruption. By contrast, he recommends the soft path of improving overall water efficiency and investing in either decentralized facilities or human capital, both of which rely on the collective actions of water users.

This type of shift in management and policy would permit users to integrate more traditional and less disruptive water technologies;

however, it would also require individuals to actively monitor and protect their water supply, as well as to voluntarily and effectively adjust their water demand. Obviously, the soft path must be accompanied by an altered perception of and a renewed involvement with one's water resources, whereas the hard path requires no such commitments. The question of which path to follow is not solely one of practicalities, but also one of ethics.

AESTHETICS AND ETHICS

Is it possible that today's urgent water problems are not being solved simply because they are not widely recognized? Perhaps, but most evidence points to the contrary. For instance, a 2004 Gallup poll suggested that Americans rate the pollution of drinking water and its sources (e.g., lakes, rivers, aquifers) as a more serious environmental problem than global warming, deforestation, acid rain, species extinctions, or stratospheric ozone depletion. The likely reasons for this high rating are that the effects of drinking polluted water on a person's well-being are more transparent than are the effects of the other environmental problems and that water's aesthetic attributes seem to be important to postmodern Westerners.

Aesthetics refer to the color and taste of water that we drink, as well as to the general appearance of water in our environment. We are more inclined to concern ourselves with environmental issues that are unsightly than with those that are less obvious—but perhaps more serious. Water has certainly achieved the status of an aesthetic commodity in Western societies; however, more traditional attributes of water (i.e., its sacredness or usefulness) seem to take precedence elsewhere in the world.

If not the recognition of water quality and quantity problems, what has thwarted our solving the ever-worsening water problems on both local and global scales? While there is no shortage of answers, one frequently cited is that many postmodern people have lost or compromised their ethics regarding water. This perceived lack of a "water ethic" was recognized in 1997 at the First World Water Forum, where the Director-General of UNESCO (United Nations Educational, Scientific, and Cultural Organization) called for a new attitude on water. Unfortunately, a United Nations committee is un-

likely to be able to successfully impose water ethics, which are instead derived from people's individual and collective perceptions of water.

People simply cannot be forced into an ethical relationship with water using legislation, litigation, regulation, recommendation, or any other well-meaning externality. Only when postmodern people begin to perceive water differently will they start to treat it differently. Some experts predict that wars will eventually be fought over water, which seems to be a logical conclusion given its current status as a commodity and an unquestionable right. After all, most nonreligious wars are fought over rights or resources.

Obviously, much of the world does not share the postmodern Western world's perception of water—at least not yet. To the extent that transnational corporations, foreign investments, and postmodern industries become part of their changing culture and relationship to water, the differences in perception between people of developing and industrialized nations will diminish. For those people whose everyday survival is dependent on collecting either enough water or water of adequate quality, the perception of water is considerably different. Collecting water is a time-consuming and physically strenuous activity that, while considered undesirable by most Westerners, has undergone little change since ancient times. What has changed is the demand on local water resources (usually attributed to higher population densities) and the lack of adequate sanitation. According to a wide range of surveys, people in developing countries remain skeptical of Western solutions (both economic and engineering) to their water crises, which are viewed as only one aspect of the many interconnected problems associated with their required, but often undesired, changes in lifestyle.

Very recent shifts in the spiritual view of water (at least by some groups) seem to have been prompted by naturalism, contemporary science, and religion. Nature itself has become the basis of a novel Western religion, which does not recognize a personalized god, intelligent creator, or supreme power that oversees the natural world. Philosopher Donald Crosby argues that Nature is both self-sustaining and metaphysically ultimate; therefore, it requires no explanation—it simply is and has always been. He views human beings as integral to

and at home in the natural world, rather than simply as visitors en route to some transcendent realm or the hereafter.[16]

According to this spiritual worldview, humans have a moral and ethical responsibility to all aspects of the natural world (e.g., water, rocks, plants, animals) that deserve the kind of reverence reserved for the one "God" of today's Western religions. Often presented in the jargon of science and naturalism, this kind of devotion to the natural world is not unlike the Nature-oriented religions common to many ancient and indigenous peoples and the previously described Eastern philosophies that recognize the natural world as autonomous and intelligent. Nature religions are seemingly aligned with deep ecology in recognizing that when we truly experience ourselves as part of the natural world, the issues of altruism and ethics become moot—we do not violate our planet and fellow species because we know them as an aspect of us.

The apparent antithesis of most Nature-oriented spiritual beliefs is exemplified by the twentieth-century revival of a fundamentalist Christian precept that is referred to as *Pre-Trib*. This precept places our postmodern world at the doorstep of the prophesied tribulation, which is both preceded and hastened by environmental destruction, holy wars, and various other worldwide calamities that portend the so-called rapture. During this anticipated rapture, righteous people make a miraculous escape to Heaven, leaving behind nonbelievers and the lingering horrors of Earth. It has been argued that this religious view complements an admittedly egocentric and materialistic society that is best served by a disposable planet—one that can be exploited, destroyed, and then abandoned as we collectively move on to the "real" paradise (however it may be envisioned). Whether or not this association is justified, there is no question that postmodern Westerners find themselves deeply divided on issues regarding the ethics and fate of water and the entire natural world. This ethical and philosophical division among present-day people has been a powerful force in creating, shaping, and sustaining an organized environmental movement.

ENVIRONMENTAL ACTIVISM

Environmentalists are usually recognized as the contemporary spokespersons for water and the natural world; however, the plight of environmentalism at the beginning of the twenty-first century is ostensibly uncertain—at least according to a highly controversial 2004 report entitled *The Death of Environmentalism*.[17] Authored by a pair of political strategists, this report concludes that the failures of the environmental movement over the last fifteen years are primarily due to: [1] an overemphasis on both technical and legislative fixes, [2] a willingness to trade long-term progress for short-term victories, [3] a resistance to forming alliances with compatible interest groups, and [4] a reliance on doomsday outcomes for motivating people to act.

In addition, the report recognizes that while public support for environmental issues in the U.S. has remained quite broad, it is also very shallow—meaning that such issues rank quite low in priority. Whereas most environmental groups dispute the report's findings, the movement has achieved only limited success in the colossal task of challenging a popular postmodern lifestyle that blindly destroys its natural support systems. Although the perceived successes and failures of today's environmentalism are a result of numerous factors, at least some of them reflect the way in which present-day Westerners relate to water as an aspect of the natural world.

Let's take a look at a few of the criticisms of environmentalism in light of our relationship to water. The use of fear in motivating people to respect and honor water is ultimately self-defeating, particularly in an age when instilling public fear has become a routine practice of the private sector and government alike. Whereas there are technical fixes for both reducing the amount of water we need and temporarily increasing the amount of water we can acquire, the complexity of Earth's climate system and water cycle—once impacted—essentially precludes any technical fix. In other words, the complex cause-and-effect relationships that scientists refer to as *chaotic* or *nonlinear* cannot be comprehended, let alone fixed. Unfortunately, this ignorance has not dissuaded us from attempting fixes on regional and global scales.

Legislative remedies for water problems can be and often are overturned in an instant, relegating most legal and political victories (or defeats) to a mere indicator of ever-shifting public opinions and

political agendas. Whereas alliances with like-minded interest groups could potentially strengthen some aspects of the contemporary environmental movement, any lasting progress is unlikely because self-serving swaps, by themselves, are usually an ephemeral substitute for a genuine connection to water and the natural world. For example, the prospect that new drugs lay undiscovered within the world's rainforests is unlikely to have saved a single watershed. Whereas emphasizing this prospect may have seemed like a clever ploy to gain support for slowing deforestation and reducing impacts to the global water cycle, there apparently have been just too many higher-ranking priorities.

If the industrial revolution has taught us anything, it has taught us that there is always a rational argument for sacrificing the natural world in the name of technological progress and economic growth. In my opinion, the "what do I get out of it, today" approach to preserving the environment actually constitutes a disservice to many people, who apparently have never considered what it is that truly sustains them. Hence, we collectively operate under the delusion that our institutions and structures really sustain us and that the natural world acts as a kind of requisite backdrop. Even for those of us living in more rural settings, our link to the natural world is often representational, rather than experiential, and mostly intellectual, as opposed to intuitional. As a result, we experience the personal or egocentric pleasure, but seemingly do not feel the planetary, trans-species, or transpersonal pain created by our industrialized world.

Added to our already strained relationship with the natural world are tales of horror from the doomsday activists, tales of wonder from the marketing wizards, and tales of every possible description from our politicians. In the midst of conflicting messages, protracted debates, and no immediate environmental catastrophe (at least not one that is readily discerned), people pursue the status quo. When our access to affordable clean water is threatened, we indignantly demand our "right to water" from the institutions that we have permitted—through a combination of indifference and sheer convenience—to intercede in our personal relationship with water.

Perhaps the only solution (albeit an extraordinarily difficult one) to people's respecting water and the natural world is a personal connection to it—all other solutions simply serve as stopgap measures

for minimizing damages until we finally do reconnect. My intent is not to indict the work of today's environmentalists (many of whom I enthusiastically support or assist), but instead to suggest that their successes represent a temporary and tenuous cessation of the attack on the natural world, rather than a healing of our connection to it.

SUMMARY

Beliefs about and understandings of water that arose during the modern era were, for the most part, either embellished upon or institutionalized during the postmodern era. Despite the abundant writings of postmodern naturalists, the existence of a well-organized environmental movement, and a reemerging "religion" of Nature, water has been legally, politically, and financially relegated to an existence as a commodity. The postmodern scientific world revealed some astonishing roles for water in our bodies, planet, and universe; however, these revelations failed to spark much of a perceptual renaissance even among well-read people. Unconventional research studies indicated that water has the potential to "behave" in some extraordinary ways and to reflect both human thoughts and etheric energies; however, nobody could explain how it does so. Water remained a part of Western religion's rituals, which had become more mechanical than meaningful and engendered no real reverence for water itself.

By the end of the twentieth century, we knew more about water and how to coerce it than we ever had. At the same time, we found ourselves in the midst of innumerable and ever-worsening water crises and a rapidly changing global climate. Perhaps we didn't know as much as we thought we did, or perhaps we failed to recognize that something besides our intellectual knowledge had gone missing.

"We have been quick to assume rights to use water,
but slow to recognize obligations to preserve and protect it . . .
In short, we need a water ethic—a guide to right conduct
in the face of complex decisions about natural systems
we do not and cannot fully understand."
Sandra Postel, *Last Oasis*

5

BALANCE: *INTELLECT, INTUITION, EXPERIENCE*

"The kind of balance that interests me is
the kind that human beings experience
between themselves and the environment…
Riding [surfing] is action and movement,
but first of all it is a moment,
a doorway in the space of time where
the person, once having abandoned
him- or herself to it, has no choice
but to engage in the present moment."
Jean-Etienne Poirier[1]

Humanity's relationship with water has been a long one. Whereas our earliest perceptions derived primarily from intuition, personal experience, myths, and legends, today's perceptions are largely crafted by the intellect in response to messages from our formal education, socio-religious groups, and the mass media. We apparently understand more about the workings of the natural world, but we tend to experience it less. We have learned how to do what we want with water, but not without violating what Nature wants to do with it. We have glimpsed the beauty and complexity of water's molecular network, but we have no clue as to what it might tell us about living sustainably with water. We have recognized water as ubiquitous and essential, but we remain perplexed about our ancestors' seemingly grandiose views of this substance. As noted by many contemporary philosophers, our postmodern Western society has failed to give humanistic meaning to scientific understandings in a way that updates our connection to water or our cultural story of the natural world.

What we may want to explore at this point in our postmodern history is supplementing, but not abandoning, what we know intellectually about water with what we experience or intuit of water. Our escalating problems with water may be a function of our literally trying to outsmart ourselves. Assuming this is true, we do not need

to become smarter as much as we need to become balanced. How might we attempt to balance ourselves?

INTELLECT AND INTUITION

Intellect is most often defined as *thought and the ability to reason or understand or to perceive relationships, differences, etc.* It currently serves as the primary mode of perceiving and understanding water, as well as for the operation of most of the postmodern institutions that render decisions and formulate policies regarding water (e.g., political, legal, financial, technical). Our intellect is associated with the objective realm of reason, logic, and observation, as opposed to the subjective realm of intuition, feeling, and direct experience. I make a distinction between objective observation and subjective experience, which I will shortly discuss in greater detail.

The clear distinction between objective and subjective modes of knowing seems to have blurred somewhat since the time of Descartes; however, the intellect does require facts, figures, definitions, and other types of input data that can be compared or contrasted. Although it can develop novel theories and explanations through both deduction and induction, the reasoning mind is always limited to what is known intellectually.

Intuition is a word that is heard quite often in modern colloquial speech and is defined as *the direct learning or knowledge of something without the conscious use of reasoning, often resulting in immediate apprehension or understanding.* There are two aspects of this definition that are crucial. The first is that intuition is dependent neither upon conceptualizing the world nor interpreting it through our five senses. Intuition often defies the apparent cause-and-effect relationships and logical processes upon which the reasoning mind is totally dependent.

The other crucial aspect of intuition is that it is instantaneous—not unlike our instinct that guides us when intellectual processes are either too limited or too slow. For example, the intellect is useless in coordinating the muscular contractions that permit us to successfully avoid a falling object or in regulating the countless biochemical reactions that maintain our bodies. The intelligence responsible for keeping us alive is considered by some philosophers and researchers to be the source of our intuition as well. Similar to instinct, intuition

supposedly guides our decisions and actions when the reasoning mind cannot.

Is the reasoning mind alone adequate for guiding our decisions and actions? Many spiritual traditions teach that it is not and, consequently, maintain that a higher knowing or intuition guides one's decision-making and interactive processes in those cases where the reasoning mind cannot access its requisite data. In other words, our intuition necessarily takes over when our intellect falters either because it lacks sufficient information or because it is intentionally shut down (e.g., while practicing various meditation techniques). The reasoning mind is considered the seat of the intellect, whereas the physical body is normally considered the domain of the instinct.

The domain of the intuition is a little trickier to identify. Some people consider the so-called universal mind to be the domain of the intuition, while others believe that it exists within a more transpersonal or collective realm that lies beyond our ordinary recognition. Still others believe that intuition is a currently unexplainable quirk of the intellect that permits a logical processing of complex information without our realizing that it is occurring. So, what exactly is intuition and from where does it originate? The short answers seem to be that we just don't know—at least intellectually.

What we do know is that intuition often arrives unexpectedly and unsolicited, delivering to us information or understandings about our world. Is this intuitive information always correct? Because it is difficult for people (particularly those who have been raised in an intellectually based society) to unequivocally attribute an insight to the intuition, the question of correctness is difficult to assess. That is to say, our inability to predictably access and then recognize intuitive insights amongst the constant chatter of our reasoning mind is no small feat. Those who are able to infallibly access and recognize their intuition usually maintain that its insights are indeed correct; however, the whole question of correctness depends on a number of assumptions that one makes about the outcome of particular actions or decisions. For purposes of our discussion, the value of intuition is simply that it provides us with another form of knowledge upon which we perceive and interact with water. Accordingly, our intuition and intellect are often described as supplementary—although not necessarily as complementary.

EXPERIENCE

Experience is an accurate but widely misunderstood word for describing a process of gaining knowledge or insight about something through a direct interaction with it. This particular usage of the word means *knowledge, skill, or practice resulting from personal involvement in or observation of events as they occur.* Similar to—and often considered an aspect of—intuition, experience is a nonintellectual process leading to insights or knowledge gained in the moment. While the intellect may subsequently utilize such insights as the basis for theories, beliefs, philosophies, or opinions, the insights originate during and because of one's immediate involvement. This immediacy is often described as an exclusive focus on, or an overwhelming feeling of, that being experienced.

Are we not constantly experiencing the world around us? The answer is an equivocal "yes" because an exclusive focus on our surroundings is a rare event for most of us. Instead, our surroundings provide a mere backdrop for the continuous thinking, calculating, and planning of the reasoning mind. For many postmodern people in the Western world, shutting down our logical mind and opening ourselves to an immediate experience of any single aspect of the natural world requires intention and discipline.

Why would we require discipline to simply focus our attention on one or more aspects of the natural world around us? The answer is that we tend to habitually engage the reasoning mind—even in those situations where it is not explicitly required. There are countless hypotheses as to how and why we have developed this habit; however, the bottom line is that most habits must be deliberately broken. Once we decide to curtail the overt activities of our reasoning mind (e.g., dialoging, calculating, judging), we begin to experience Nature through a more deliberate involvement.

While such an attention shift enhances the quality and depth of our observations, we continue to be influenced by the intellect in a more covert, or subtle, manner. This subtlety is related to the way that most of us have been taught about the natural world: namely, through words, symbols, images, and other representations. Hence, when encountering a particular aspect of the natural world (e.g., water), we immediately associate it with its representations, rather

than truly experiencing it in the moment. Philosopher Alan Watts described this phenomenon as mistaking the map for the territory. In doing so, he described the formidable challenge that most of us face in experiencing the world without first conceptualizing it as innumerable representations, which necessarily limit our genuine experience of it.

Our conceptualizing, in lieu of genuinely experiencing, the natural world may be limiting in several ways. First, we substitute a personal and intimate connection to water for representations that may or may not jibe with our genuine (but too often limited) experience of it. Second, our perceptions of water are difficult to change due to the unconscious and immediate linking of our recognition to our conceptualization. Third, conceptualizing water reduces the number of individual or unique perceptions that exist because so many of us learn about the natural world through similar representations. The alternative to a representational relationship with water is not obvious to many of us postmodern Westerners because we tend to be detached from the natural world and, instead, live in accordance with man-made systems (e.g., political, financial, legal) that do not foster a genuine relationship with the natural world. Because water readily assumes the role of a commodity; any break from this entrenched collective perception requires a real commitment—something that can be more challenging than the actual change in perception.

A DOMINANT INTELLECT

We seem to have reached a major crossroads in our postmodern relationship to water. On the one hand, we intellectually know more about water than we ever have—at least as far as we can discern from conventional interpretations of history. On the other hand, we are faced with a so-called water crisis (as a component of global environmental degradation) that has arisen during the exact time period that our intellectual knowledge of water has grown by leaps and bounds. How is this possible? Most answers fall under one of three general headings. First, the water crisis is a result of many and varied postmodern factors (e.g., water pollution, overpopulation, global climate change, agricultural practices, hydrologic constraints) that fortuitously conspired to create the present situation. Second, the potential for

such factors to create a water crisis was neither unexpected nor unpredicted, but instead was deliberately ignored in hopes that technological solutions alone would alleviate the need for us to make substantive changes in our priorities and lifestyles. Third, the crisis is fundamental to our perception of water; hence, we may have been unable to predict it from our vantage point even though it was inherent in our decisions, actions, and policies.

Whatever the cause or causes of the water crises, we are a society of "doers" who seem to have an irresistible urge to sit down, roll up our sleeves, and get to work on solving it. The paradox is that we are sitting down with the exact same perception of water that created the problems in the first place. The seeds of a continuing water crisis (in the form of our perceptions) are likely to bear fruit in whatever solutions we implement. Thus, we find ourselves in a never-ending cycle of devising solutions that necessarily create problems, which inevitably require additional solutions to overcome those problems.

If our perception of water is truly fundamental to the crisis, then what is the source of our postmodern perception? The answer seems to be our intellect—at least the predominant source. The intellect is an important component of our addressing the water crisis, but can it serve as the sole component? Will we be able to effectively address the water crises without balancing and integrating our intellectual knowledge of water with intuitive and/or experiential knowledge?

While the answers to these questions are not known for certain, there are indications that we are not going to be able to simply reason our way out of these water crises. The attempt of UNESCO to instill a global water ethic, the increasing rejection of water privatization schemes, the destruction of human and ecological communities by dams, and the failed or ignored policies of water resource agencies are just a few examples suggesting that political, engineering, and economic solutions alone will not suffice. And why should they? Until we can regain some relationship to water that transcends a commodity, a right, or an inert molecular liquid, we are unlikely to treat it differently.

Would an intuitive and/or experiential knowledge of water assist us in solving the current crisis? Perhaps—we don't know for sure. So, why would we choose to make the effort to perceive water differently? One answer is that we have tried a number of other

approaches and, despite their anticipated results and considerable costs, we have been unable to break the aforementioned cycle. Another answer lies in the apparent successes, rather than in the specific understandings, of our ancestors' utilizing water in a comparatively sustainable and responsible manner—although not necessarily one that we might consider to be easy.

Is a sustainable relationship with water dependent on the perception of water as substantially more than its mundane uses and observable characteristics? Will our exploring an intuitive and/or experiential connection to water bring us the same insights as it apparently brought our ancestors? And is there something about the intellect alone that inhibits people's ability to live in harmony with water and the natural world? Again, we don't know for certain.

A contemporary grassroots movement has focused on reviving (or at least recalling and reexamining) ancient perspectives of the natural world in order to broaden our postmodern views. Whereas some people advocate our adopting these ancient views, most others simply anticipate that our exposure to such reverent, although often perplexing, views will prompt us to change or to consider a change.

Whereas intuitional and experiential insights may have underlain many of the great achievements in today's most recognizable fields (e.g., economics, politics, law, the sciences), such insights are rarely spawned directly from these intellectual endeavors, but more often in spite of them. Much of the work emanating from these fields has reportedly progressed along predominantly logical lines (e.g., the scientific method), including trial-and-error and deductive reasoning. No twisting or cajoling of intellectual endeavors will produce intuitive or experiential insights, nor will forcing such insights into the established protocols governing intellectual endeavors magically transform them into some New Age amalgam. Certainly, intuition has played and will continue to play some role in all intellectual fields—although usually through practice, rather than through doctrine.

By doctrine, science identifies and culls hypotheses and research that do not correspond to its tenets, or rules. This discrimination ensures that other forms of inquiry into or accounts of the natural world (e.g., mysticism, intuition, myth, subjective experience) are neither mistaken for nor represented as science. The designation of "unscientific" or "nonscientific" in no way indicates that a theory or

perspective is invalid according to Nature's laws, but only that it violates science's rules.

As a consequence of our so closely associating the discovery or approximation of Nature's laws with the adherence to science's rules, too many of us postmodern Westerners have looked exclusively to science to validate, or sanction, our perception of the natural world. This reliance is not only limiting (i.e., restricts our perception of water to a single modality), but also it places science in the rather awkward position of addressing topics (e.g., water's memory or sentience) that exceed its capabilities and violate its rules. Moreover, our identifying science as the only legitimate view of the natural world has, in my opinion, encouraged the mislabeling of many interesting (but clearly not scientific) theories and research studies. The postmodern era is replete with pseudoscience that has been fashioned by attempts to forcibly merge, rather than to just supplement, science with non-intellectual insights. Formulating our perception of water solely on knowledge acquired according to science's rules essentially denies the intuitive and/or experiential aspect of us that "knows" water. Alan Watts had the following comment on this topic:[2]

> *For the game of Western philosophy and science is to trap the universe in the networks of words and numbers, so that there is always the temptation to confuse the rules, or laws, of grammar and mathematics with the actual operations of nature . . . Although thought is in nature, we must not confuse the game-rules of thought with the patterns of nature.*

THE NONINTELLECT

The ways in which we can know water through intuition and experience are myriad. My experiences in seawater have provided me with an understanding of and appreciation for the oceans that far surpasses anything that I learned in conjunction with my academic pursuits. I have been fortunate in having the opportunity to both work and play in kelp forests, coral reefs, alpine lakes, warm springs, and tropical waterfalls. The combination of my observing water and immersing myself in natural waters—particularly as an avid surfer—has permitted me to connect with water in a variety of ways. Surfers

often talk about their intimate connection to the ocean and Nature through total immersion into and synchronization with the waves, as was described in this chapter's opening quotation. By necessity, their lives accommodate the rhythm of Nature and its influences on seawater, rather than the artificial schedules imposed by conventional work and deadlines. Surfers and other nature-oriented people are predictably regarded as bohemians who blatantly reject postmodern societal norms. In my view, the renegade image of surfers is often exaggerated, though their experiential connection to water is not.

In the previous chapter, I mentioned a few of the twentieth century's naturalists who were particularly focused on the substance of water. It is worth reiterating that their insights regarding water were not gained through sophisticated laboratory experiments or complex computer models, but instead by observing, meditating upon, and so-called "merging" with the natural flow of water. While they did perform simple studies and devise water treatment and conveyance schemes, these were based solely on their intuitional or experiential insights—not on traditional engineering designs or accepted scientific theories. In fact, most of their designs and theories have been either rejected or ignored by mainstream technical communities. Their writings are curiously reminiscent of ancient and indigenous peoples' reverence for and perceptions of water. While these naturalists may have simply embellished upon ancient views, the specificity with which they describe water's behavior suggests otherwise.

Perhaps the most eloquent of the modern water naturalists was Theodor Schwenk, whose classic book *Sensitive Chaos* is most often listed under the heading of "art."[3] It is no coincidence that art and music often represent the sole vehicles for providing postmodern Westerners with a nonintellectual glimpse of water. While painters and sculptors throughout history have employed water as the subject of their work, today's photographers and filmmakers seem to be even more focused on the beauty and mystery of water (see Figure 5-1). In his popular book *The Message from Water*, photographer Masaru Emoto posits that human thoughts, words, and feelings affect the crystallization of liquid water.[4] His microscopic photographs of ice crystals have assisted many people in shifting their perceptions of water, even though his methodology is more artistic than scientific.

FIGURE 5-1. Photos of an ice crystal (in the form of a snowflake) and a drop of water hitting a still water surface. Nature photographers, videographers, and special effects artists routinely use water as a subject, making it one of the most recognizable aspects of the natural world. Whereas these types of photos have always provided people with novel ways of perceiving water, a number of today's naturalists have expanded the role of such photos in order to infer the quality, history, and information content of water collected from different sources. Although not currently recognized by science, these techniques have gained considerable popular recognition and will be discussed in the following chapter. Photos by Lori Sparkia (**A**) and Kerry Werry (**B**).

A **B**

Water has long been a theme for musicians and, very recently, has been recorded in Nature (e.g., streams, oceans, waterfalls) so that people who cannot access natural waters can listen to their sounds. Even water sounds that are normally inaudible to humans, such as those produced by the changing tides, have been recorded and then sped up so that we may hear them. Although art and music do not represent direct experiences of water, they do provide people a way of relating to it without having to engage the intellect.

The subject of intuition is one that engenders quite a mixture of reactions in today's world, ranging from skepticism to uncertainty to conviction. Although not usually considered a component of intellectual endeavors, intuitional insights have reportedly permitted numerous scientists to maneuver past logical dead-ends and research gaps—giving rise to some of the most innovative and unexpected understandings in science. Albert Einstein is frequently quoted as proclaiming that, "All great achievements of science start from intuitive knowledge, namely in axioms, from which deductions are then made."[5] *Axioms* are essentially truths that require no proof of their validity. From these universal truths, Einstein posited that scientists deduce the workings of the physical world through their many and varied theories.

It has been suggested that some scientists purposefully create a setting or mood that will facilitate the emergence of these intuitive truths, which the intellect then distills into theories and philosophies. Arguably, the most widely recognized and meticulous descriptions of intuition as a means of both understanding and interacting with the universe are those credited to the early-twentieth-century philosopher Rudolf Steiner. Similar to Einstein, Steiner viewed intuition as the source of knowledge that facilitates thinking; however, he considered intuiting and thinking as practically inseparable. Steiner maintained that intuition supplies us with the piece of reality missing from that which we observe in our world.[6] In other words, intuition acts as the missing link between what we observe and what we think, which collectively (i.e., observing, intuiting, and thinking) comprise what I—not Steiner—refer to as our perceptions. I have elected to contrast subjective observation (i.e., experience), as the combination of observing and feeling, with objective observation, as a combination of observing and thinking.

Steiner believed that intuition, or intuitive thinking (as he referred to it), was a spiritual method of knowing the world and, specifically, those aspects of the world that are unavailable to direct observation. He taught that the spiritual practice of intuitive thinking could be approached with the rigor and discipline of traditional science, and he often contrasted intuitive thinking with mysticism, metaphysics, and abstract philosophies. It is interesting to note that Steiner and his followers wrote extensively about an etheric constituent of the physical world (i.e., the aforementioned A-field) that we cannot directly observe, but that interacts with and ultimately influences the matter, forces, and effects we do observe.

In addition to Steiner's approach to intuition, there are countless other spiritual approaches describing techniques to access a universal knowledge that lies well beyond the human intellect. While people engaging in traditional introspective practices such as meditation may not label the resulting knowledge as "intuition," their insights are definitely gained by circumventing routine intellectual processes. In addition, those beings who succeed in attaining extraordinary states of consciousness are able to clearly articulate an understanding of the world that invariably eludes most of us.

RECONCILING A BALANCE

Although most of us cannot coax our intuition to produce on demand, many humans seem to know somewhere deep within their psyche (even in the midst of today's materialism) that water is more than it is routinely acknowledged to be. We postmodern Westerners are incredibly fortunate in having access to the best of all possible worlds when formulating, or reformulating, our perception of water. The natural sciences provide us with the most powerful tool for intellectually understanding water that humans have ever known. Moreover, we have access to the insights of modern naturalists and, through their teachings, to methods of accessing and understanding Nature that date back as far as the Renaissance era. Through many spiritual and religious traditions, we have access to both nontechnical explanations of water and nonintellectual practices for connecting to water (e.g., meditation, prayer, sacred ritual). Finally, the work of countless anthropologists and archeologists provides us with some inkling of how ancient peoples perceived and revered water.

While facing some monumental decisions regarding water, we arguably possess more tools at our disposal today than we ever have for meeting these challenges. The question is how to transform these sundry techniques and diverse understandings into a twenty-first-century perception of water—assuming that we choose to do so. Cosmologist Brian Swimme suggests that our collective transitioning into a new postmodern era might include acquiring an experience of the universe at the same time that we learn scientific facts about it.[7] Writer Dirk Dunbar refers to this combination of intellect and intuition/experience as an *integrative knowing*, which he describes as a knowing or understanding that is rationally based, insightfully perceived, and experientially verifiable.[8]

Our balancing between the three different ways of perceiving water may grant us a perspective that is more valuable than that from any one of them alone. Consciousness researcher Brenda Dunne suggests that a balance between intuition and intellect serves science itself by avoiding unproductive lines of investigation and also by minimizing erroneous interpretations or self-delusion.[9] Perhaps our challenge is less about actually reviving intuitional and experiential

abilities than it is about deliberately employing them (as we do our intellectual abilities) in decision-making and planning processes.

Another compelling reason for our reviving an experiential or intuitive connection to water relates not to what we know about water, but instead to what we don't know. Similar to ancient peoples, many of us recognize that Nature's design is both mysterious and more intricate than we are able to interpret from our intellect and physical senses (both gross and extended). The paradox is that many of our modern-day actions lack the humility inherent in this recognition. In other words, we act as if we understand more about Nature (including water) than we actually do. Damming or changing the course of rivers, pumping carbon dioxide into the ocean depths, altering local precipitation patterns, and draining wetlands are all performed under the mistaken assumption that we can forecast, assess, and undo the consequences of our actions.

Have the cumulative effects of water and watershed management practices contributed to or even exacerbated global climate change? We don't know. What we do know is that, absent a personal connection to or reverence for water, we tend to make decisions solely from an intellect that is often lacking in knowledge and humility.

Can we reasonably expect these three modes of inquiry to produce perceptions of water that consistently corroborate one another? No, we really cannot. In fact, there seems to be little reason that we should—at least at present. Our ability to genuinely experience the world, to reliably access and recognize our intuition, and to intellectually understand the world through the natural sciences and other disciplines will inevitably change over time. At some point in our evolution, each of the three modes may produce indistinguishable perceptions of the universe—but until that time, we must reconcile perceptions of water that sometimes concur, sometimes conflict, and sometimes appear unrelated.

The vastly different forms in which we receive these modes of knowing (e.g., thoughts, calculations, feelings, dreams, sensations, sounds, visions, hunches) further complicate our using one of them to validate the others. Whereas a comparison of perceptions derived from the different modes is both fascinating and potentially useful, I believe that an overemphasis on comparison—to the exclusion of

integration and balance—is actually detrimental to our expanding the prevailing postmodern perceptions of water.

SUMMARY

Because intellectually based endeavors (including science, logic, economics, and engineering) have achieved a position of dominance in our postmodern era, they often serve as the yardstick by which everything else is measured. By contrast, most ancient wisdom and spiritual traditions claim that these types of mentally- and sensory-derived endeavors are so limited that they can provide us with nothing more than an illusion of reality. Whereas we postmodern Westerners are probably not prepared to abandon our intellectual view of the world (nor should we), it appears that some degree of balance may assist us in dealing with the water crises and the highly publicized, but relatively unabated, degradation of our natural world. The brief 105 years of postmodern history suggests that our simply knowing more about water or managing water more cleverly is not, by itself, going to permit us to meet the challenges we currently face. I conclude this chapter with a quotation from philosopher and physicist Jeremy Hayward, who wrote the Foreword for a collection of interdisciplinary essays on the subject of intuition:[10]

> *When we experience the world directly, beyond the filter of conception, we live that world. We are in the world and the world is in us. We can love the world, and the world can love us. When we experience only a world programmed by our conceptual conditioning, we merely exist, as if in a dead world. And we destroy life.*

6

CREATIVITY: *TIMELESSNESS, CHILDREN, NATURE*

"The passion for discovering how things work has never lessened. So, the reason I hated science, or the one that occurs to me now, was the way in which it was taught. In the schools where I served my time, it was taught in a way almost perverse, not as a means of appreciating the natural world, but as a denial of it."
C.L. Rawlins[1]

The title of this chapter may appear to be a little out of place in a book focusing on human perceptions of water. Nevertheless, creativity is *the ability to display imagination and inventiveness*, which will be required to address the many water crises that our planet and its inhabitants (both human and nonhuman) currently face. Based on material presented in the previous chapter, I would argue that we will likely require every mode of inventiveness we can amass in order to address our relationship with water and the natural world. It is probably time that we honestly examine why our previously successful tactics (or more correctly, temporarily useful measures) for preserving Earth's ecosystems and resources now seem to be of limited value. If our intellect, cleverness, and ingenuity alone are not the answer, how might we supplement these traditional problem-solving tools? Might the requisite creativity lay dormant, or simply unrecognized, in places and people that we rarely associate with addressing crises of this nature and magnitude? Does it reside with our imagination, our children, or our ancient ancestors' rituals?

Some people maintain that straying from the established norm is precarious, while others believe that the most precarious position we can assume is our current one—it all depends on how we perceive the watery world around us. Naturalist Thomas Berry notes that our best approach may be to concede that we need an Earth solution, rather than a human solution, to our crises.[2] Berry's approach re-

quires the humility to limit our interfering in natural process and the ability to listen to what the Earth and water are telling us.

A TIMELESS WAY

In 1979, architect and professor Christopher Alexander authored a book entitled *The Timeless Way of Building*.[3] While his subject matter is architecture, the creative modality that he describes is applicable to any endeavor. He refers to this creative process as the *timeless way*. This modality is timeless in the sense that it is exactly the same today as it has always been. In the words of Alexander, "Indeed it turns out that, in the end, what this method does is simply free us from all method." While this sounds like a contradiction in terms, the timeless way is not about learning, copying, or even modifying accepted methods that have been used in the past, but instead about opening up a creational process that is inherent in us. In his view, we are encumbered by rules, concepts, ideas, theories, interpretations, and teachings that essentially limit our innate creativity. He suspects that we do not deviate from these "proven" methods of creating for fear of jeopardizing our professions and reputations.

Yet Alexander believes that within this unknown territory, which naturally arises from the timeless way, exists a subtle order that is far more creative than anything we could construct from what we know or understand intellectually. Alexander also believes that the fear of delving into this realm is related, in large part, to our letting go of the images, or illusions, that seem to reliably and acceptably guide our lives. We cannot access the timeless way as long as we adhere to preconditioned or stereotypic ideas and opinions about our lives, our work, and ourselves. Only when we are able to break through these illusions about ourselves are we able to access the timeless way. Alexander notes that there is definitely a collective resistance to such a breakaway because it threatens the established societal norms, most of which he believes are rooted in an array of mutually agreed-upon illusions.

Alexander maintains that we cannot create in the timeless way unless we do so from an egoless perspective. He uses the word "egoless" not in the sense of egotistical, but rather in the sense of our being cognizant of our persona, or personality, and of how it might

be judged by others. In that rare place where people actually forget themselves, they naturally attain an innocence that allows them to access the timeless way—at least according to him. Employing the terminology of various ancient cultures, it is necessary for the personality to step aside and allow the more expanded aspect of one's being to step in and guide the creative process. Admittedly, this is an extremely difficult task for most of us postmodern Westerners because our society places such a high premium on *doing* rather than on *being*. Our self-worth and perceived approval by society hinges on what we do rather than who we are, which (paradoxically) may limit what we can do. In Alexander's own words:[4]

> *It is utterly ordinary. It is what is in you already. Your first, most primitive impulses are right, and will lead you to the right thing, if you will only let yourself. There is no skill required. It is only a question of whether you will allow yourself to be ordinary, and to do what comes naturally to you, and what seems most sensible, to your heart, always to your heart, not to the images which false learning has coated on your mind.*

So, how does one go about separating oneself from the mental coatings in order to let the timeless way take over and guide a creative description of the natural world? A subset of the so-called naturalists may represent the best example that we have for utilizing such a process, particularly in our postmodern Western world. Instead of using cleverly designed experiments or sophisticated computer models to coax the secrets from Nature, naturalists simply observe and meditate upon Nature. They often describe this process as allowing Nature to speak to or communicate with them. Are they actually being spoken to or are they simply allowing themselves to bring forth what they already know?

In previous chapters, I have referred to insights of Theodor Schwenk, who reportedly studied the natural movements of water for extended periods and eventually developed a means of capturing water's flow forms in photographs, which he used to assess some of its qualities. As one trained in science, I immediately recognized that Schwenk's insights were gained neither through reasoning nor the

scientific method, but instead through experiences and intuitive perceptions that permitted him to transcend the conventional views of water. Alexander describes a similar process as discovering or recognizing natural patterns in space and time—not for the purpose of identifying cause-and-effect relationships, but instead for recognizing that relationships are inherent in the mosaic of hierarchical patterns.[5] Schwenk noted that his observational methods might be challenging for others (particularly in the beginning); however, he believed that everyone eventually could develop the patience to observe water and receive its messages.

Similar to Alexander's timeless way, Schwenk often writes about watching water with "unprejudiced eyes" and not allowing our preconditioned thoughts to interfere with our innocent observations of what actually is. Otherwise, we are simply pasting our present understanding (or lack thereof) on the natural world, rather than genuinely observing it. Our inability to perceive water as a living being or entity is, according to Schwenk, a result of the way we have been taught to conceptualize water.

A number of contemporary naturalists with their own unique interests in water have introduced us to some creative ways of perceiving and experiencing water. For example, Craig Childs writes of his many adventures in discovering and learning from water in desert regions, whereas William Marks undertook a 7000-mile horseback journey in order to personally experience the waters of the U.S.[6,7] In addition, water naturalists and flowform designers John Wilkes and Jennifer Greene are relating their methods of experiencing and intuiting water through both their words and their ability to emulate water's natural movements in engineered systems.[8,9]

Whereas few people possess either the opportunity or desire to experience water as do the naturalists, observing or meditating on the natural world in a more limited way is often sufficient to quiet our minds and open ourselves to a different kind of relationship with water. In the final analysis, the mysteries of Nature that appear to reside outside of us may be nothing more than aspects of ourselves that we are striving to remember. Despite the many doors that our advanced technical, industrial, and scientific prowess have opened for us, we have reached a point where we must search outside of this modern and postmodern prowess to open (or more accurately, to

reopen) essential doors. This is not a question of which culture or tradition or perception is endowed with the greatest degree of truth and accuracy, but rather a choice of which keys are appropriate for opening the doors in front of us.

CHILDLIKE PERCEPTIONS

It is unlikely that many of us living in the postmodern Western world have mastered the ability to intuitively explore the secrets of the universe; therefore, this section explores the perception of water through the eyes and ears of children, who are often more receptive to and trusting of their intuition than are adults. During the writing of this book, I was given the opportunity to observe a group of kids who lived on the island of Kaua'i and ranged in age from eight to thirteen years. My interaction with the children focused on exploring their perception of water and the natural world. Although I am the son of an elementary school teacher, all my teaching experience has been at the university level.

Because I have no children of my own, my interactions with children have been confined primarily to my niece and nephew, who live on the other side of the world from me. Children I spoke with (or more correctly, learned from) came from diverse ethnic, economic, and scholastic backgrounds. Some attended public school, whereas others were home schooled or attended a charter school. I had the privilege of spending the most time with a small group of kids who attended a Kaua'i-based charter school that specializes in traditional Hawaiian methods of education (e.g., chant, dance, song, storytelling, hands-on experience), which are interwoven with more contemporary (i.e., representational, intellectual) modes of learning.

When presented with questions regarding their perceptions and understandings of water and its role within the larger natural world, the children's responses were quite varied (see Table 6A). Some responses were obviously gleaned from concepts that they read in books, heard on the news, or were told by their parents and/or teachers. These responses were the least interesting to me and often reflected both judgment (e.g., right vs. wrong, should vs. shouldn't) and prognostication (e.g., the anticipated outcomes of various human actions or decisions). Other responses were focused on the mech-

anisms by which water interacts with humans or other aspects of the environment. Most of these responses reflected either the children's intellectual learning (e.g., an understanding of the hydrologic cycle) or their experience with water in their world (i.e., via surfing, fishing, farming, or observing). Combined responses were considerably more interesting to me because they exemplified the children's creativity in filling the gaps in their intellectual knowledge.

TABLE 6A. Children answered the following questions in ways that were predictable (probably based on things they learned in school or at home) and surprising (probably not based on things they learned or even on things they experienced in a conventional sense). These responses were selected from answers provided by approximately 35 children during 2004 and 2005.

QUESTION	PREDICTABLE RESPONSES	SURPRISING RESPONSES
What exactly is water?	A clear liquid. H_2O. Ice and steam. It can be polluted.	Life. Blood. Invisible. It is very old. It knows things.
Where does water come from?	Clouds. Rain. Evaporation from oceans. The ground.	Outer space. The stars. Nowhere—it is everywhere.
Who owns the water on Earth?	Some people. Guys who drill wells. The government.	God. The Earth. Everybody and everything. Nobody.
Why is water important to us?	We drink it. Our bodies need it. It makes plants grow.	We are water. We came from it. Water is everywhere.
Does water have a memory?	No. It cannot think. The fish remember where they live.	It always knows where to go. It remembers clouds and animals and plants.
Is water alive?	No. Maybe—but we can't see it living. It is too big.	Yes. It is alive because it moves and changes. It is alive in us.
What is water's fate In our world?	It is polluted. Sometimes it floods. We may run out.	Water always comes back. It will show us what to do.
Do we need to find more water?	Yes. No. Don't waste it. In the ground. From the ocean.	We can get water from outer space. Water will find us.

At times, the children appeared to be supplementing their intellectual understanding of water with relationships and/or processes

interpreted from their personal experiences. On occasion, I was treated to intuitional insights that seemed to transcend anything that the children could have gleaned through personal experience. These insights included the existence of water in outer space, the ubiquity of water in the universe, various concepts regarding living water, and the curious understanding that we (as living beings) are essentially water that, in turn, is somehow able to guide us. Notice the similarities between ancient views of water and the children's responses—even among children who supposedly had minimal exposure to indigenous ways of relating to the natural world.

Another observation I made from my brief and admittedly unscientific survey was that children from public schools were more likely to respond with "I don't know" than were children educated in less conventional settings. I was acutely aware of the "I don't know" response because it is one that I often encounter from adults responding to similar questions that I pose during my lectures. In fact, it is a response that I frequently use myself. I was taught—as both a student and a scientist—not to "make things up," but instead to respond honestly when I do not know something, or at least when my intellect cannot formulate the answer to a question. While this response is certainly honest and very appropriate in some situations, it also tends to stifle intuitive insights that may be less accessible and precise than are intellectually derived answers.

Investigations of children's descriptions of the natural world have revealed that the most common understandings seem to transcend markedly different backgrounds, suggesting that such understandings probably arise through experiences with the world around them.[10] Children reportedly cling to their experientially derived perceptions of the natural world, despite an educational system that insists that they are wrong. It has been recently recommended that teachers not simply replace children's experiential or intuitive understandings with the "correct" information, but instead offer children an intellectual (i.e., scientific) explanation that supplements their worldview.[11] Such an approach is less likely to dampen children's enthusiasm for science (in spite of its changing and often confusing explanations) and more likely to preserve their sense of connection to the natural world. I suspect that, at least in certain instances, the intuitive knowledge of children originates from a more fundamental (although seemingly

more simplistic or unsophisticated) view of the natural world than do the largely mechanistic explanations of science. Although not always complementary, diverse perspectives and explanations of the natural world are invariably supplementary.

Children's interest in science notwithstanding, our personal connection to and genuine appreciation of the natural world is perhaps the most important task facing the industrialized world at the dawn of the twenty-first century. I believe that many of the environmental crises, and perhaps some of the personal tragedies, we are frantically trying to avert might either disappear or abate if we connected to and altered our perceptions of Nature (including water). Children are of particular importance because they have far fewer mental coatings to peel away than do we adults; however, fewer and fewer children are apparently connecting to the natural world. That is to say, children are spending less and less time experiencing the natural world around them. Recent studies indicate that *nature-deficit disorders* in children are on the increase. These disorders reportedly include a diminished use of the senses, a wide range of attention difficulties, and a high rate of both emotional and physical illness.[12]

Instead of focusing on children's ability to excel on standardized tests or to conform to Western societal norms, perhaps education could instead focus on children's innate connection to our planet and fellow species. It is interesting to note that a human's ability to learn through representational methods, as was discussed in the previous chapter, develops sometime between two-and-a-half and three years of age. Younger children apparently treat symbols strictly as real objects rather than as a combination of real objects and representations of something else.[13] Hence, our earliest and, probably, our most fundamental knowledge of the world is based entirely on experiential and intuitional modes. Perhaps children's eventual transition into a representational mode of learning could be achieved without their abandoning either the intuitional or experiential insights that merit encouragement, rather than ridicule or correction.

The current model for teaching children has been described as a commodity that is both fragmented and mechanistic, allowing it to be incrementally and uniformly delivered.[14] Educational consultant and innovator Stephanie Pace Marshall argues that true learning cannot take place in absence of stories, experiences, and questions that foster

a child's sense of belonging to something larger than himself or herself. Perhaps the kind of creativity required for our dealing with the water crises has been inadvertently squelched by an educational system designed to achieve other objectives. An overdependence on representational learning necessarily leads to the collective acceptance of perceptions that lack diversity and, perhaps, any real resonance with our inner knowing. Marshall has the following to say about the process of learning:[15]

> *Learning emerges from discovery, not directive; reflection, not rules; possibilities, not prescriptions; diversity, not dogma; creativity and curiosity, not conformity and certainty; and meaning, not mandates.*

COMBINING PERCEPTUAL MODES

If creativity is enhanced by our combining different perceptual modes, might there be any postmodern examples for doing so? The answer is "yes," there are many examples; however, I have chosen to focus on one that includes many of the topics presented in the previous five chapters. We begin with the observations of Theodor Schwenk, whose intuitive and experiential perceptions of water I have referenced throughout this book. Schwenk viewed water as a mediator of energies and information among various aspects of the observable world, as well as a link between the unobservable (etheric) and observable (material) realms. He further hypothesized that there must be easily recognizable attributes of water that could indicate the quality of water's "essence" and information; hence, he devised a number of novel techniques for evaluating both conventional and unconventional attributes of water. His original methods of testing water have been adopted and expanded upon by many researchers from around the world.

One of Schwenk's methods includes the so-called *drop pictures*, whereby water is dropped onto a still water surface and the resulting macroscopic patterns are photographed. Several research groups currently use this method for [1] differentiating between water from various sources, [2] assessing water quality according to qualitative rather than quantitative (e.g., chemical testing) attributes, and [3] experiencing water in a way that offers insights into its origins and

contacts with its natural surroundings.[16] The intuitive insight that water's properties (both gross and subtle) may be discernable in its macroscopic patterns or geometries seems to have been shared by several groups of water naturalists.

Because the gross geometric structure of liquid water cannot be easily observed, the naturalists cool liquid water to its freezing point and create ice crystals that can be observed and photographed. Differences in network geometries and molecular dynamics between water's solid and liquid phases had long been suspected of confounding any meaningful comparisons between the appearance of ice crystals and the attributes of liquid water. Surprisingly, these water crystallization techniques apparently reflect subtle attributes of the liquid (as do drop pictures), perhaps corroborating the notion that causes at higher levels of complexity influence effects at lower levels.

Besides the highly popularized photography of Masaru Emoto, a group of German researchers have adopted a systematic method of preparing, freezing, and analyzing water samples.[17] Their method is reportedly used to qualitatively assess the molecular structuring or clustering of water, as well as to identify its so-called *vital forces* and *information content*. Although exactly how they validate correlations between these subtle water properties and the patterns (geometries) observed among ice crystals is not entirely clear to me, their method is seemingly unique in its ability to discriminate among different influences on the same water sample.

These researchers discovered that water from the Ganges River displays ice crystals characteristic of pollution and of pristine springs. They refer to this anomalous mixture as "polluted water with a very high energy level."[18] Apparently, the Ganges River water conveys information on at least two distinct levels—one related to its recent impact by various pollutants and the other related to the location of its origin or, perhaps, to a life force that is often associated with the etheric realm. They also found that most of the water samples from New Zealand produced crystals indicative of pristine sources, even when the water had been chemically treated, bottled, or stored for long periods—all of which usually result in adverse effects on the formation of ice crystals, regardless of the source water's chemical or microbial purity.

So, how might these different modes of perceiving water assist someone in expanding their overall perception of it? Well, let's briefly review some of the previous discussion points. The first was Schwenk's intuitive and/or experiential insight that drop pictures would reveal something about the history and quality of water. The second was a corollary of this insight that suggested liquid water's quality may be reflected by macroscopic patterns or geometries in ice—despite the lack of an accepted scientific explanation. The third was a scientific understanding that both liquid and solid water exist as interconnected networks of individual water molecules. The fourth was a nonscientific theory that such networks are capable of storing and accessing information and that network structures (i.e., degree of clustering) affect water's physical properties (e.g., surface tension). The fifth was an intuitive insight that water may transmit information on multiple levels, perhaps related to its hierarchical networks. And finally, there was the experiential insight that while someone's drinking water from the Ganges River is definitely risky, bathing in the water may impart a vital force or spiritual cleansing.

I have obviously taken many liberties in compiling this example; however, the point is that a perception of water derived from several modes can be more expanded and able to offer more options than one derived from any single mode. Moreover, this example is not meant to demonstrate that the resulting perception of water is either logically or experimentally verifiable, but rather to illustrate how combining different modes may allow us to perceive the natural world in a different and, perhaps, a more balanced way.

There is yet another practical reason for our perceiving water from a more expanded foundation, which is related to the prospects of reasoning our way through the current water crises. As previously noted, the reasoning mind relies on cause-and-effect relationships that it considers to be confined to the level of the perceived crisis or problem; hence, we often fail to recognize causes that emerge from higher levels of complexity. This failure may explain why our solutions so often fail to achieve their anticipated results or achieve their results at the cost of creating unanticipated problems. Recognizing higher-level causality may be more likely to emerge from modalities such as intuition and experience than from intellectual endeavors because the former are far less restrictive in their scope. Moreover,

our perceiving the natural world as a mosaic of interconnected patterns and cyclic events may dissuade us from inferring incomplete or erroneous cause-and-effect relationships that are based on the observations we make from a limited number of hierarchical levels within Nature.

AN OUTLOOK ON PERCEPTIONS

What may be useful at this point in history is our creating, or re-creating, a perception of water that will supplement our primarily intellectual perceptions of it. An integrated perception of water may or may not include adopting ancient and indigenous people's beliefs, some of which may be inappropriate for our contemporary Western culture. Instead, our postmodern perception of water may emerge from a combination of science, naturalism, spirituality, art, music, and any other perceptual modalities that we employ to rediscover water. The real value of familiarizing ourselves with ancient and indigenous worldviews may be to provide us with proven models for combining perceptual modes and for accessing the natural world.

Can we utilize the gift of water and, at the same time, know that water is more than that represented by its mundane uses? Will such a *knowing* change the way that we treat and manage water? It will do so if our perceptions truly guide our actions. Perhaps our emphasis will change from managing water (i.e., something that we either do to it or force it to do) to working in concert with water and its natural cycles and rhythms. As I asked at the beginning of this chapter, are we humble enough to adapt to water's nature or will we continue to demand that water adapt to ours?

Does this proposed change in emphasis necessarily mean that all water collection and conveyance systems will be abandoned? No, it means that the design for such systems will be influenced more by a respect for water and the intelligence of Nature than by a need to appease short-term political and financial interests. In other words, it means preserving natural watersheds and flow regimes, rather than forcing water to conform to man-made structures and boundaries. It means recognizing that the underlying causes of local water problems (e.g., droughts and floods) are actually global in scope and must be addressed on that scale. It means halting the translocation of water

from far-away sources in order to exploit otherwise uninhabitable and, from our limited viewpoint, unproductive environments. It means recognizing that global change may not be the underlying cause of our water crisis, but instead an unforeseen consequence of our past management of water and watersheds. It means learning where the water from our taps originates and how dependent we are on the watersheds that provide our tap water. It means recognizing that other planetary life both depends upon and enhances the quality and quantity of water that we divert from those watersheds. It means connecting to water and the natural world as if our human lives depend upon them, because they surely do.

Questions about utilizing Earth's resources without degrading them and about managing natural resources during rapid climate change were raised in a recent article by water scientist and professor T.N. Narasimhan, who suggests that we develop methods of using resources that are flexible enough so that we can alter our use patterns when the resource becomes stressed or degraded.[19] Of course, this adaptive approach implies that we can monitor the resource status in real time and that we are willing to alter our use patterns accordingly. In the case of water, real time evaluation is a difficult proposition because significant impacts to watersheds and aquatic ecosystems often occur prior to our recognizing water scarcity or degradation.

Narasimhan asks whether we will choose to begin living with Nature in a more adaptive manner (probably incurring economic costs and even political disruptions), or whether we will continue to modify Nature to meet our desires (hoping for and depending upon technological solutions to address resource scarcity and degradation). It is worth reiterating that most technological solutions have served only to forestall, rather than to solve, the global water crises—permitting us to temporarily avert the consequences of a lifestyle that we fervently defend as something we have earned.

With regard to the global water crises, the whole question of "adaptation versus modification" is moot. We humans and all of our cherished institutions are wholly dependent on the Earth and its resources (water and otherwise); hence, we ultimately have no choice but to adapt. The choice is whether we adapt to a planet that has been slightly modified, or to one that has been continually modified

by our attempts to fix the largely unforeseen consequences of prior modifications. In my view, today's water crises, as well as the water-related effects of global change, are largely a consequence of yesterday's decisions to modify, rather than to respect and emulate, natural systems. Ultimately, it is our choice—individually as well as collectively—as to whether or not we alter our current perception of water. In the interim, water will continue to serve as a mirror for gauging our perceptions of it and the entire natural world. Thomas Berry reminds us that the Earth is a faithful scribe, a faultless calculator, and a superb bookkeeper.[20] Consequently, we twenty-first century humans can always check our balance sheet if we so desire.

SUMMARY

Addressing the current water crises will likely demand a post-modern creativity that differs from the ones utilized in the recent past to address seemingly similar problems. It is not so much that we need to be more creative as it is that we need to balance our creativity among several perceptual modes—some of which may be relatively unfamiliar to most of us. While our intellectual knowledge and technological prowess will undoubtedly assist us in addressing these crises, it appears that this duo alone will not suffice. Besides our reasoning mind, we will need to utilize our innate connection to, our intuition of, and our personal experiences with water and the natural world—perhaps in ways that reflect the wisdom of naturalists, children, and indigenous peoples. A recent article suggests that creative people often have interests in a broad range of subjects and in purely aesthetic qualities, which they draw upon and combine in the process of formulating novel solutions.[21] In addition, the reported flexibility of creative people to effortlessly switch between brain states that are receptive (meditative) and active (logical) facilitates their manifesting creative solutions.

Perhaps many of us postmodern Westerners have inadvertently omitted an important component of our creativity when it comes to addressing crises that we view as demanding a strictly logical or intellectual approach. It is quite likely that a unique combination of intellect, intuition, and experience will eventually emerge from our present situation that best addresses the problems we postmodern

humans now face. I conclude with a rather provocative quotation by naturalist and philosopher Thomas Berry, who I have referenced all through this chapter.[22]

> *Something more than the utilitarian aspect of fresh water must be evoked if we are ever to have water with the purity required for our survival . . . We cannot discover ourselves without first discovering the universe, the earth, and the imperatives of our own being. Each of these has a creative power and a vision far beyond any rational thought or cultural creation of which we are capable.*

"Self-interest comes naturally and it seems more hopeful to expand the sense of self to include the air (my breath) and water (my blood) and soil (my body), than to suddenly imagine most humans becoming "selfless," acting against their perceived self-interest to protect these things."
John Croft, ***Gatherings***

7

APPLICATION: *SEAWATER, SOUND, INTEGRATION*

"There is such unlimited movement in this sheath of water encompassing the earth that it can on a global scale even be regarded as an organ mediating between earth and cosmos, integrating the earth into the course of cosmic events and enabling it to take part in these events."
Theodor Schwenk[1]

In this chapter, I describe a very unscientific perception based on my applying some of the suggestions that I proposed in the previous two chapters. Essentially, I have attempted to communicate in words (at least to the best of my ability) my experiential and intuitional perceptions of seawater and their relationship to my intellectual views. This communication was more than a trivial challenge for at least two reasons. First, a great deal of my training and education has been in the natural sciences; hence, I am familiar with many of the theories applied to seawater and, therefore, I am predisposed to Christopher Alexander's so-called mental coatings. Secondly, it is very difficult to ensure that my intellect is not coloring my observations or intuitive insights as they are necessarily routed through my logical mind to convert them into words. For this reason, it is sometimes easier for a person with very little intellectual knowledge of a particular aspect of Nature to remain innocent in his or her perceptions of it. Difficulties often associated with expressing such perceptions in "relevant" terms seem to be more than compensated by a person's innocence.

Whereas I can do nothing to change my background, I selected a topic that has intrigued me since childhood, permitting me the opportunity to recall experiences and intuitive insights that preceded the acquisition of most of my mental coatings. The application of my combined intellectual, intuitive, and experiential perceptions of water is truly a work in progress.

AN UNSCIENTIFIC PERCEPTION

The physical properties and basic chemistry of the oceans are very well described, yet scientists understand far less about the micro-scale intricacies of seawater (e.g., clusters, hydrogen bond dynamics) than about those of pure water. During the twentieth century, oceanographers discovered volumes about the pivotal role that seawater plays in global processes. Despite this invaluable scientific research, the oceans remain the most enigmatic compartment of the planet's surface. Even the insights left to us by our ancestors are seemingly unclear regarding the role of the oceans.

While unmistakably created from the primordial sea or chaos (as was everything else), the Earth's oceans were frequently portrayed as shape-shifting and mood-swinging gods that were able to disrupt the orderly state of the physical world. Not unlike the ultimate chaos of the primordial sea, the perceived chaos of Earth's physical oceans was considered to be extremely powerful and nearly as unpredictable. It is interesting to note that postmodern science has identified the oceans as the instigators of relatively rapid climate shifts, resulting in an extensive history of worldwide species extinctions and permanent changes to both land and sea.

Ancient myths provide little understanding (even symbolically) of the ocean's inner workings; nevertheless, they do characterize the oceans in some interesting ways. One of the most interesting is the ancient Maori designation of the oceans as the planet's largest crystal. The purpose of a planetary-scale crystal, let alone the manner in which the oceans may serve as one, is beyond anything gleaned from myths or conjectured from scientific understandings. Are the oceans similar to crystals in their electrical and heat conductivities, in their optical properties, or in their functioning as semiconductors?

Postmodern naturalists have tended to concentrate on freshwater, which is ultimately derived from seawater. One reason for their concentration on freshwater may be that streams, rivers, and lakes are small enough to permit naturalists to observe the formation and interaction of vortices, eddies, waves, and boundary effects. The scale of the oceans is so enormous (e.g., major ocean vortices, or gyres, measure hundreds to thousands of kilometers in diameter) that it is difficult to observe such phenomena except via satellite imagery and

other sophisticated technologies. Hence, naturalists often experience seawater in the form of shallow underwater or shoreline phenomena. Does the manner in which seawater is experienced determine the insights that are gained? The answer really depends upon the nature of the insight.

Descriptions and understandings pertinent to specific flow forms are certainly dependent on observing and maybe even touching the patterns created in both space and time. As such, the interaction and resulting insight are primarily experiential. Primarily intuitive insights, which are often activated by a direct experience with seawater (as opposed to sitting in meditation or walking down the street), may be less dependent on which aspects of seawater are experienced. In other words, observing surface or shoreline oceanic processes may indeed provide an appropriate trigger for intuitively perceiving a global-scale function of seawater or for simply remembering what we already know. This process probably sounds strange to most of us who were taught to perceive the natural world and its governing laws through intellectual processes.

Is our access to natural laws constrained by time and space or, for that matter, are the laws themselves time and space limited? Well, the physical laws developed by science are applicable to specified realms of time and space, beyond which they are of limited value. The precise relationship between our physical laws (as admittedly narrow descriptions of the observable world) and natural laws (as universal principles governing the entire manifested world) is unknown.

TUNING INTO SEAWATER

Some of the most fundamental questions about the oceans are those that address the water itself. After spending a lifetime in and out of the stuff, I have come away with a number of diverse experiences and intuitional insights. I never cease to be amazed by the feel of seawater as I run my hands through it—a frequent habit of mine while I am sitting on my surfboard waiting for the next set of waves. I also take the opportunity to touch seawater wherever I find it. I've been known to pull off my boots during a Canadian winter to put my feet in seawater and get a feel of it. In all my years of entering seawater (wherever I have encountered it on the planet), I have rarely

exited without feeling much better—physically, mentally, emotionally, and spiritually. Although I sometimes exited the ocean with coral cuts, jellyfish stings, numb hands, and stingray barbs, I have never been dissuaded from reentering. Seawater is my major gateway to connecting with the Earth and the entire natural world. While I love, deeply respect, and have worked extensively with freshwater, it is seawater to which I have always been most drawn. The reason that I refer to "seawater," rather than to "the oceans," is that the oceans encompass more than just their liquid medium of seawater, including all of the biological organisms and geological features.

I remember that my first impression of seawater was its vastness: not only in terms of its great depths and coverage of the Earth's surface, but also in terms of its seemingly analogous relationship to the entire universe. Similar to the universe's giving rise to the galaxies, stars, and planets, I believed that seawater must have given rise to the dry land, the air, and the life forms on this planet. This belief was firmly established before I learned that Earth consisted entirely of water in its early history, that seawater was probably the major constituent of life's "original soup," that seawater is the ultimate source of the clouds and all freshwater, and that the combination of the Sun and seawater are responsible for Earth's climate regimes.

When I first learned of seawater's remarkably constant salt (ion) content, as it pertains to both the total salinity and the contribution of each of its constituent salts, I often wondered whether such constancy might permit seawater to serve as some kind of code for the Earth. I imagined that relationships between different ions or ion groups somehow held the secret to initially creating and constantly recreating the diversity of forms and processes we observe on Earth. I remember writing a story for my high school English class that detailed the fictitious exploits of a mad scientist who successfully converted the salt content of seawater into an alphanumeric code and, in doing so, discovered how to predict major global events such as the ice ages, earthquakes, volcanoes, pole shifts, and species (e.g., dinosaur) extinctions.

Despite my training as a scientist, I have never been able to shake my intuitive insight that many of the questions we have about the Earth's past and future are somehow contained within or mediated by seawater—if we could only access the information. Would the

information in the seawater answer questions about its origins and about the environmental challenges that we now face? I envisioned the code as being nearly unbreakable—not because it was too complex, but instead because it was too subtle; hence, people would stare right through seawater and never realize it contained a wealth of information. Later, my undergraduate coursework in marine ecology taught me that biological organisms represented the most interesting and complex aspect of the oceans and that seawater simply supported the required chemical and physical processes for their survival. Upon completing my graduate degrees and becoming an applied water scientist, consultant, and adjunct professor, I abandoned my youthful insights for a period of about twenty years.

The insights returned to me unexpectedly one winter when I had the opportunity to get into the ocean with a population of humpback whales on their subtropical breeding grounds located just north of the Dominican Republic. I remember being awed by the whales' size, grace, and almost indescribable presence—but above all I remember being mesmerized by their song. While I had previously listened to recordings of humpback whale songs, such recordings were hardly adequate to prepare me for hearing (and especially feeling) a live performance. Suddenly, I was returned to my visions of seawater as the medium for both guiding and recording the fate of the Earth, as well as for linking our planet with the rest of the cosmos. Perhaps it was the otherworldly quality of their song, which is often compared to Eastern music or to planetary noises, combined with my intellectual knowledge of similar songs being sung by whales around the world, that led me to suspect that the whales were communicating—perhaps not just with each other, but also with the Earth, the biosphere, and the seawater itself. I will explore a more intellectual aspect of this insight in a subsequent section.

Regardless of a scientific training that directed me to do otherwise, I was unable to abandon my intuitional insight that seawater was fulfilling a role that was heretofore not described—at least not by anyone with whom I was familiar. This was the impetus for my researching ancient perceptions and contemporary molecular theories of water, both of which were eventually included in *Universal Water*. During the ensuing years, I frequently took time out from my ocean-related activities (e.g., surfing, swimming, kayaking) to quiet myself

and pay as close attention as possible to what was occurring within and all around me. There were two observations that intrigued me. The first was a never-ending interaction of waves possessing different heights, directions, and periods. While swimming in Hanalei Bay during the summer, I was regularly treated to a static representation of interacting waves in the form of sand contours on the bottom. I noticed that these contours changed with wave direction, height, and period, such that I could often anticipate the patterns that I would observe during my swim.

The second observation was the incredible diversity of sounds generated underwater and in the air above the water. Perhaps my experiences with humpback whales during the same period made me more receptive to oceanic sounds, or perhaps I had previously tuned out sounds that blended together as pleasant but monotonous "background noise." Background noise is something that most humans either habitually or purposely ignore to focus their attention on more immediate, and presumably more relevant, environmental signals. In doing so, they filter out a tremendous amount of information, as is evident from recent discoveries of natural phenomena that scientists had long dismissed as meaningless noise in the data. For millennia, this noise may be exactly what informed many ancient peoples of the natural world. It would be interesting to know which sounds they heard with their physical ears and which ones they interpreted with their nonphysical senses.

A SOUND ENVIRONMENT

Am I currently able to interpret the interfering wave patterns and the cacophony of sounds that I routinely experience? The answer is "no"—at least not in a way that I am accustomed to interpreting the world around me. That is to say, I am not able to identify the precise information that they carry (assuming they do so), but I am able to articulate a general feeling or intuition of the ways in which they may do so. I have not yet developed the requisite sensitivity or receptivity to download messages from the natural world in the way that my ancestors apparently did. With patience and perseverance, I believe my ability to recognize and interpret these messages will improve. My intuition suggests that seawater routinely receives input regarding

diverse planetary conditions (e.g., atmospheric, geological, biological) in a variety of different forms. This information is then reflected in seawater's poorly described hierarchical networks, which are able to integrate the different inputs and to serve as the "control center" for regulating planetary processes. In addition to receiving information from all planetary compartments, Earth's seawater also receives input from both solar and cosmic sources via interactions with high-energy particles and electromagnetic radiation.[2]

Because it was sound, or mechanical waves, in seawater that revived my early insights about the oceans, I became interested in the kinds of sounds that might interact with seawater. A comparison of the acoustic frequencies for earthly and cosmic events is shown in Table 7A and may be compared to the rhythms for water's molecular network (as hydrogen-bond exchange rates) listed in Table 4A.

TABLE 7A. A comparison of frequencies and representative wavelengths for various mechanical (sound) waves is presented below. To approximate the wavelengths corresponding to these frequencies, an estimate for the speed of acoustic waves within the various media was required. Speed varies as a function of the medium and differing conditions within it. Conditions for the media were selected to produce representative values, which are intended to facilitate gross comparisons only. Hydrogen was assumed to be the medium for cosmic sound waves; however, the actual medium may be different.

SOUND SOURCE	MEDIUM*	FREQUENCY (hertz)	WAVELENGTH (kilometers)
Meteor explosion[4]	Air	0.1 to 0.2	2 to 3
Volcanic eruption[5]	Air	0.1 to 10	0.3 to 3
Swimming fish[6]	Seawater	1 to 10	0.2 to 2
Oceanic "hum"[7]	Seawater	0.3 to 0.06	5 to 25
Earthquake	Rock	0.5 to 20	0.3 to 10
Planetary "hum"[8]	Rock	0.002 to 0.007	hundreds to thousands
Black hole[9]	Hydrogen	~10^{-15}	quadrillions (light years)

** Representative sound speeds include: 420 meters per second in hydrogen, 330 meters per second in air, 1500 meters per second in seawater, and 5000 meters per second in rock.*

Whether or not seawater is influenced directly by acoustic waves originating within cosmic or solar events, it is interesting to compare the vastly different frequencies that characterize "sounds" in these realms. As an example, scientists at NASA's Chandra Observatory identified one of the lowest frequency sounds ever detected in the universe emanating from a massive black hole located about 250 million light years from Earth.[3] This low frequency vibration, which may be a key to understanding the way in which galaxies actually formed, has been identified as a single note (*B flat*) at about fifty-seven octaves below *middle C*. More relevant to seawater are the sounds generated by sources such as volcanoes and earthquakes. Some interesting and unexplained aspects of sound in the oceans are presented in the second section of the Appendix.

My intent in presenting Table 7A is neither to drag technical perspectives into a predominantly intuitive description of seawater nor to suggest that I understand (mechanistically) how seawater might serve to retain or mediate vibrational information. Instead, I simply want to illustrate that the dynamics of water's fundamental network exhibits a rhythmic range that, when converted to bond-exchange frequencies, includes many micro- and macro-scale events affecting the Earth. I was fascinated by the recent discovery of Earth's so-called *continuous hum*, which lies well below the human hearing range and has been linked to events as diverse as winter storms, ocean-rock interactions, climate shifts, and subtle variations in gravity.

Several aspects of this planetary hum are fascinating. First, the hum is not caused by common seismic events such as earthquakes or volcanoes, as was originally suspected. Instead, the hum appears to emanate from the interaction of ocean waves that are whipped up by the strong surface winds associated with winter storms.[10] In other words, the vibrational energy of wind-generated oceanic swells are transmitted thousands of meters downward into the abyssal depths and, ultimately, into the underlying rock. Second, the hum does not represent a single note or even a predictable grouping of notes (e.g., a "chord" indicative of earthquakes or other common seismic events), but rather about fifty individual notes that are played within a tonal range of two octaves.[11] The hum is played about sixteen octaves below *middle C* and the time between notes varies from about two to eight minutes (translating to a rhythm on the order of thousandths of

beats per second). Individual notes comprising the hum are not just repeated monotonously, but instead are constantly appearing in and disappearing from the planetary score.

Additionally, the hum varies daily and seasonally—playing louder from noon through evening than from midnight through morning and louder during winter than summer in both the Northern and Southern Hemispheres. Finally, the planetary hum is known (technically) as a *free oscillation*, which is substantially more complex and vibrates much slower than does an ordinary seismic wave. In fact, seismic waves are simply layered over the continuous low-frequency hum, which was long considered by geophysicists to be background noise. This complex standing wave carries with it some interesting information about the Earth as a consequence of its presumed sensitivity to global climatic regimes and to other changing conditions within the planet's oceans and crust.

One can only imagine how this hum might have varied over the course of Earth's 4.5-billion-year history. It might be interesting to transpose the hum into our audible range or to simply speed it up and listen. Using similar techniques, composer John Duncan created a "musical" CD entitled *Infrasound-Tidal*, which contains temporally compressed recordings of tidal and barometric events that were recorded in Australia over extended time periods. The discovery of Earth's hum has prompted scientists to ask whether other planets possess a similar hum or whether the unique earthly combination of air, ocean, and rock is a prerequisite.

The oceanic equivalent to the planet's continuous hum is the ocean's *seismic hum*, which exists within a slightly higher frequency range than does the planetary hum, but which is linked to many of the same planetary events. Although first discovered in the early twentieth century, the oceanic hum has recently been linked to global phenomena as diverse as climate change, El Niño, ocean temperature dynamics, coastline changes, tectonic stresses, and seismic activity.[12,13] Similar to the planetary hum, the oceanic hum is a standing wave that results from diverse wave-wave interactions and serves to connect atmosphere, hydrosphere, and lithosphere. In fact, wave interference patterns result from the ocean's acting as a wave energy mediator that permits the vibrational signature of ever-changing surface conditions to be acoustically transmitted to the underlying solid rock.

OCEANIC RESONATORS

As the largest animals on Earth, blue whales not only create the loudest songs in the ocean, but also they create songs that are quite rhythmic. Bioacoustics researcher Christopher Clark has reportedly determined that the interval between song notes of the blue whale is exactly 128 seconds or, if a note is missed, 256 seconds.[14] The time interval for this note repetition converts to a rhythm of about 0.004 or 0.008 hertz, closely matching the frequency range of Earth's hum (see Table 7A). Might there be some connection between the blue whale's songs and the planetary hum?

Perhaps more puzzling than the rhythmic notes uttered by blue whales are the intricate songs of humpback whales inhabiting the planet's oceans. Although the rhythmic patterns and complicated acoustics of humpback songs have been described in painstaking detail, scientists have been unable to identify the purpose of these elegant and ever-evolving compositions. Current scientific research on humpback whales indicates that their songs probably serve as an intraspecific mode of communication employed by males to attract females or to warn other males; however, nobody has been able to demonstrate the essential link between subtle song differences and reproductive success. Interestingly, humpback songs appear to be more constrained by structural stability, or rhythm, than by specific tonal frequencies. This observation raises the question of whether humpbacks could transpose the sounds that they hear (or feel) within higher or lower tonal ranges—as can humans and dolphins.

Roger Payne is the scientific researcher who has arguably spent the most time with humpback whales. He observes that humpback songs are similar to human musical compositions in that they employ rhythms and phrases, are of a similar structure and length, and contain both rhymes and percussion (e.g., clicks).[15] The first question Payne asks about these songs is why humpbacks employ similar rhythms. Unlike human musical compositions, the humpback whale songs change slightly from year to year through the addition of a few segments or phrases and the deletion of others. The songs continue to evolve until they are completely revised, perhaps communicating more complex types of information than was previously theorized.[16] The whales may sing where and when they do for some very good

reasons if, in fact, their primary objective is to broadcast the songs as far as possible. Payne has looked into the acoustics of seawater and found some interesting implications for humpback songs, although his views are not necessarily shared by other whale researchers.

If the whales are trying to broadcast their songs over distances on the order of oceanic basins, they must overcome or minimize the attenuation of sound intensity as a function of distance and various underwater features (see the second section of the Appendix). Payne has suggested that the whales may actually use *sound channels* to guide sound waves through the deep oceans, thus incurring minimal losses of energy due to reflection, refraction, and absorption.[17] Sound channels are actually determined by the horizontal layer of the coldest water, which is curved perfectly to match the curvature of the Earth. Whereas the so-called *sofar* sound channel is quite deep (about 1300 meters) in subtropical oceans where the whales breed and sing, they are able to launch their songs into the channel by taking advantage of deep ocean islands or seamounts (e.g., Hawai'i) around which they congregate. In other words, the whales are able to sing at relatively shallow depths and still get their songs into the sound channel because the sound waves descend the seamounts. To take advantage of the sound channel, humpbacks must make their annual pilgrimage to the Earth's tropical and subtropical oceans because these channels do not exist in the higher-latitude temperate and polar oceans.

Deep ocean channels may be great for sending a whale's song over long oceanic distances; however, they are not optimal for either navigating or communicating with other whales. Not only is the sound channel too deep for most listeners to dive, but also the listener must be stationed at a precise distance from the singer to hear the sound in phase. If the whales are neither communicating with each other nor navigating, then what is it they may be doing with their songs? It has been suggested that the humpback's constantly changing their song might create the longest sonic envelope on the planet, approximating the circumference of the Earth itself.[18] Unfortunately, we still know too little about the oceans or the whale songs to postulate an answer. What we do know is that humpback songs have a seemingly universal effect on human emotions. Roger Payne asked whether the whale songs may reflect a universal music that is awaiting discovery and whether they may mimic the patterns

of energy that were responsible for creating the universe. Science has no answers to these questions; however, the Maori culture of New Zealand teaches that the song of the humpback whale is a sacred sound that is sent to the planet and the stars, thus sustaining all life on Earth. Barry Brailsford has described the Maori insight into the whales' song and migration as follows:[19]

> *An agreement, cast into the water when there were different stars in the sky, bound them to these trails and the challenge of the long tides that spanned the Great Orb that is the Mother. All life within the ocean needed to hear the song, to be reassured, season after season down through time, that the sacred sound that gave them life, and sent it forward, still held sway.*

PERCEPTIONS AND ACTIONS

So, how do these diverse descriptions of seawater serve me in balancing my perception among the three modes? Not unexpectedly, my unscientific insights leave me with a few perceptions that are fairly consistent among all three modes and many more perceptions that appear to be supplementary, but not complementary. And how do I choose to act when confronted with these different perceptions? My answer is that I act as if they are all relatively true. In other words, I act in a manner that acknowledges the personal truth of these perceptions in the moment and, at the same time, recognizes the inevitable shifts in my perceptions. Some of my perceptions will shift more than others as I continue to connect with water and the natural world. I generally choose not to make one perception more valid or acceptable or correct than another, which would necessarily mandate my discounting an important aspect of who I am and how I relate to water.

I am often asked about situations in which my perceptions of water conflict with one another. My answer is twofold. First, my perceptions rarely conflict; however, they often seem to emerge from different vantage points. Second, some perceptions simply feel more resonant or natural than do the others, suggesting to me (sometimes illogically) the perception that is most relevant—at least for the moment. This is not necessarily a perception that I embrace forever, but

rather one that prompts me to ask questions, thus contributing to further shifts. Similar to the nature of water, the more fluid I remain in my perceptions, the more that other perceptions of water (not just my own) seem to resonate with me. By contrast, the more rigidly I cling to a particular view of seawater or the natural world, the more I see different views as conflicting with mine. The only perceptions that I reject are those that feel awkward or dissonant or unnatural—meaning that they appear to violate the grace, efficiency, and underlying beauty (even in the midst of apparent disruption or chaos) of water and the natural world.

My choosing to study science had more to do with acquiring a language (both verbal and mathematical) for expressing my intuitive and experiential insights about the natural world than with seeking its ultimate answers. My graduate degrees included courses in the socio-political aspects of water resources because I wanted to dialogue with those who serve as humanity's stewards of water and the Earth. My use of the word "stewards" is somewhat tongue-in-cheek because neither water nor Earth requires our stewardship, even if we humans were capable of providing any. Instead, we seem to require constant stewardship because we have seemingly lost our ability to recognize the guidance offered by Nature.

I believe there is a profound wisdom inherent in the Earth and the entire natural world that produces actions and reactions that best serve the whole, whether or not we humans are able to recognize this wisdom in the face of events that appear utterly destructive or unnecessary. That we so rarely acknowledge the wisdom of either the planet or the natural world is a testimonial to our ignorance and arrogance, the combination of which continually entices us to intercede in processes that are incomprehensible to our intellect and that often involve Earth's primary mediator of energy and information—namely, water.

Perhaps more important than anything else, my spending a great deal of my life in the oceans has offered me a glimpse of Nature's elegance and wisdom, which both informs and is informed. That seawater performs such functions is in accordance with both my intuition and my experience; however, my reasoning mind struggles mightily to propose plausible mechanisms by which seawater could do so. This intellectual struggle does not discourage me because I

know that the limits of logical and scientific plausibility will continue to expand. Will these limits expand far enough in my lifetime to permit me to identify the mechanisms by which water informs and is informed? Whether they do or not will certainly influence my explaining such insights to other people, but my personal connection to water and the oceans will remain unaffected.

I am sometimes asked whether my perceptions of water have led me to ponder whether this remarkable substance was created by an intelligent designer (e.g., a Creator or God) or fortuitously arose from the precise unfolding of our universe according to its physical laws. My response is "rarely, if ever." I consider water's design to be inherent in Nature itself, rather than as disconnected objects (particles) that are either designed and set into motion by a subject (Creator) or randomly combined and scattered throughout the cosmos according to science's incomplete description of cause-and-effect relationships. When questioners insist that the mere hint of a design indicates the presence of a Creator, I reply that water is the Creator, just as everything is both Creator and creation. As such, my use of the word "Creator" is more similar to previous descriptions of the Tao than to the personal God portrayed by most Western religions.

While often considered to be pivotal, the exclusionary debate that pits *intelligent design* against *chance* (even if resolvable) brings us postmodern Westerners no closer to genuinely connecting to the natural world. Regardless of our differing beliefs about Nature's origins, the most pivotal issue—at least from my standpoint—is whether we can connect to water and the natural world in a way that includes, but also moves beyond, intellectual descriptions in facilitating an eventual shift in our perceptions and actions.

I realize that my lifelong connection to water is not something that will personally resonate with most people. My explaining the ways I perceive seawater is not meant to convince others to perceive it in the same way, which is tantamount to my offering just another intellectual construct. Furthermore, my perception of water is no more or less valid than is anyone else's perception. Instead, I hope to spark people's awareness that the hierarchical levels of complexity on which the natural world operates may prevent us from really discerning how we affect, or fail to affect, water and the planet. In combination with our inability to feel the pain of the Earth or our

fellow species, this lack of discernment means that we really do not know how, or to what extent, we may be affecting them. Until we can reconnect in a way that will inform us more completely, our best interim tack may be to emulate water and Nature to the greatest extent possible in all our decisions and technologies.

PERCEPTUAL MODES REVISITED

Whereas science is yet unable to identify the complex and diverse cause-and-effect relationships operating within the global water cycle, scientists have observed an acidification of the oceans (due to carbon dioxide loading) and the changing of oceanic circulation patterns (due to a speeding-up of the water cycle). Some of the most critical environmental issues (e.g., severe weather, global warming, El Niño) actually result from the unpredictable ways in which oceanic, orbital, and solar cycles interact with one another and with today's human activities. These cycles, as recognizable patterns in both space and time, are of vastly different scales and durations. Moreover, events occurring successively within the same cycle or simultaneously within different cycles may not be related to each other as cause-and-effect, but rather as part of a grander event known as Nature. Our ability to discern the hierarchical levels upon which global cause-and-effect relationships operate is limited to the levels of complexity that we are able to recognize and, occasionally, quantify.

If we focus on the molecular-scale (rather than the global-scale) roles of water, we are confronted with similar hierarchical issues. For example, the attendees of a recent London conference explored the question of whether biological life is possible without water. It has been suggested that water is not a great solvent for life's biochemistry and that all of water's unique physical properties may not be required to sustain biological life.[20] Additionally, a handful of biomolecules (e.g., enzymes) appear to function without water in some laboratory studies, despite the fact that water-free enzymes do not exist in any living organisms on Earth. While life elsewhere in the universe may indeed utilize solvents such as ammonia (rather than water) as its matrix, the fact that water is an integral constituent of earthly life suggests that its roles are not limited to the physical and chemical processes currently identified by science.

Admittedly, we cannot explain why water is required to sustain earthly life or determine whether water's recognized properties are a consequence of more fundamental or quintessential roles. As long as water is perceived merely as a solvent for biomolecules, the questions leading to an intellectual understanding of water at higher levels of complexity will never be asked. Not unexpectedly, intuitional and experiential insights of people outside mainstream science have been largely responsible for posing unconventional questions; however, such people can rarely answer the questions scientifically. In the process of combining perceptual modes, we humans (collectively) may be able to expand the limits of our recognizing water's roles within Nature's hierarchy. The combination of my experience, intuition, and intellect suggests to me that a great deal of our difficulties with water may be traced to our perceptions of it.

I believe that water acts as one of the primary mediators of both information and energy within the observable world and, perhaps, between observable and unobservable worlds. As a mediator, water is easily overlooked and taken for granted, despite the recent interest in it. Those who hypothesize that water is involved in disseminating information often choose to look inside water to find the source of the information, just as someone who had never seen a radio might dismantle it in an attempt to find the person whose voice is heard. But water, not unlike a radio, may simply broadcast information that is transmitted on the many channels to which it is tuned at the moment—a moment that changes every trillionth of a second. Whereas one can depress the pause button and freeze the information stream on a single image, this is hardly the same as deciphering the entire broadcast. Water's ability to mediate the flow of information may be as much dependent on its dynamism as on its molecular structures or observable crystals. Although recent popular interest has focused on water's geometries, the ultimate source of water's magic may reside within its rhythms.

From my perspective, the real mysteries of water relate to how it may select and switch channels and how it may tune into the source of its broadcasts (whatever that source may be). Have the oceans been described as a planetary crystal because of their role in tuning into such sources? Is water tuned to the A-field, or to diverse hierarchical layers within Nature, or to some unobservable aspect of our

universe, or to a combination of all these and many more? Whatever its ultimate source of information, water is able to perform feats that no other substance can match. The astonishing subtlety with which water performs these feats is the main that it is so easily overlooked and, thus, taken for granted.

Water's simplicity belies its complexity, whereas its use in trivial human tasks belies its role in monumental, but often indiscernible, universal tasks. Our perception of water seems to be split between intellectual concepts that serve to explain it, but not to grok it, and experiences or intuitive insights that serve to grok it, but not to explain it.[21] Our utilizing different modes of perception may permit us to better grok it, to better explain it, and to better address our largely self-imposed water crises.

The poet David Whyte, when interviewed for the documentary *Water: Sacred and Profaned*, observed that water embodies the sacred or intimate conversation of one part of the natural world with another. I conclude with the last stanza from a poem written by him and recited as part of the documentary.[22]

> *And the sea remembers and sings back from the depths, where nothing is forgotten.*

"If there is magic on this planet, it is contained in water."
Loran Eisely, ***The Immense Journey***

EPILOGUE AND ACKNOWLEDGMENTS

On a personal note, I would like to revisit a question that I posed in the book's Preface regarding my own altered perceptions of water. Although the question of how I abandoned or trivialized my early experiential and intuitional insights was originally intended to be rhetorical, several reviewers of this book suggested that I actually answer the question. My first inclination was to attribute these perceptual shifts to an educational system that favors intellectual understandings over experiential or intuitive insights. However, the educational system alone could not have been responsible because, throughout my educational stint, I was involved in water-oriented activities that continually offered me enjoyable and sometimes profound experiences. In addition, I always maintained some degree of skepticism about teachings disseminated by the educational system.

My second inclination was to attribute the perceptual shifts to my work and, specifically, to the demand that I accept "established" protocols for solving water and environmental problems. Whereas my tacit acceptance of established protocols was often required by my work, I was never beyond questioning the wisdom and ethics of such protocols. Furthermore, I was always aware of my limitations (as well as those of other applied environmental scientists) in both understanding and fixing such problems. The extent to which intellectual perceptions of water supplanted my experiential or intuitional insights of water was less attributable to a blind faith in the value of intellectual perceptions than to a decision to accept them as real—or at least to act on them as if they were real. Besides, no matter how ineffective the solutions or misplaced the causality, this was a reality within which I could apply my intellectual knowledge. By contrast, I had no clue as to how to apply the majority of my experiential and intuitional insights, even if I had seriously considered doing so.

Taking a retrospective look at my life, I find that the answer to how I had become so identified with my intellectual perceptions of water is twofold. Stated succinctly, these perceptions served me in my career (e.g., building a reputation, gaining acceptance, pursuing success) and provided me with a personal sense of developing a tangible understanding of water and the natural world that could be

practically applied. It was a sensation of learning something tangible about water and Nature that really enticed me, even though an aspect of me realized that intellectual understandings alone would never completely satisfy me and that most of my proposed fixes simply fulfilled regulatory mandates. All the while, I was able to sequester my experiential insights away from my "real" work and, in doing so, preserve the illusion that my intellect would eventually supply me with the answers I sought.

A week of living on the ocean and diving with humpback whales provided me with just the right combination of competing sensations (e.g., awe, humility, connectedness) to force me to confront my illusion. My childhood insights into water and genuine respect for Nature returned to me in a way that I could not ignore or trivialize. I was captivated not so much by the content of my early insights as by the recollection of a process (or more correctly, the absence of a process) that facilitated such insights. My most formidable tasks now include reliably accessing experiential and intuitive insights and then integrating them with the intellectual understandings that I consider both fascinating and essential to my total perception of water.

The first of these tasks demands that I simply allow things to happen, whereas the second appears more transpersonal and is often elucidated by my sharing with others, as through speaking or writing. Hence, this book is as much a vehicle for my clarifying the tasks before me as it is a vehicle for suggesting to other people that their perceptions of water are crucial in permitting all of us (collectively) to deal with the daunting challenges of the twenty-first century. As such, I would like to acknowledge all the present and future readers of *Altered Perceptions*. Additionally, I thank the readers of *Universal Water*, as well as attendees of my lectures, whose feedback has influenced this book's content. I offer special thanks to Alandra Napali Kai and Leslie Larsen for reviewing early drafts of the book. I also thank the representatives of the schools (especially the Kanuikapono Learning Center) who generously invited me to interact with their students. Finally, I extend my lifelong thanks and eternal gratitude to the water and oceans of Earth.

APPENDIX

1. THE MYSTERIOUS AETHER

Perhaps the most puzzling of all water's bizarre attributes is its association with the so-called etheric portion of the manifested world. This association is not simply one that appears in arcane myths and fanciful legends, but one that has been continually raised throughout history—from Plato's symbolic geometries to indigenous people's life forces to Schwenk's meticulous observations. The challenges involved in our piecing together this puzzle are many and varied; however, the most daunting challenge is that the etheric realm (assuming that it exists) lies beyond our current observational and experimental capabilities.

Even though the etheric realm is hypothesized to affect matter, energy, and cause-and-effect relationships within our observable world, we are somehow unable to detect its presence. As a predominantly empirical endeavor, science historically has denied the existence of such a realm. The paradox is that science can only deny the existence of that which it is able to detect and measure—namely, ordinary forces and matter. If the etheric realm does not consist of ordinary forces or matter, empirical science can only infer its existence (or nonexistence) through any effects that it may have on the observable world.

Astrophysicists have recently posited that there is a mysterious force, as well as an unknown type of matter, that affects the gravity-related phenomena of universal expansion and galactic rotation. Additionally, scientists have known for some time that a vacuum cooled to absolute zero (-273 degrees Celsius) still retains some form of energy, which is referred to as zero-point in Chapter 4. While scientists struggle with these seemingly contradictory observations, theoretical physicists have proposed that the fundamental forces and particles of our universe are actually a result of vibrational differences among tiny strands of energy. These tiny strands of vibrating energy are known as *strings*, which are theorized to constitute the most fundamental constituents of matter and forces—perhaps exemplifying what the ancient Greeks referred to as undividable "atoms." Similar

to Pythagoras, theorists claim that vibrating energetic strings, rather than point-like particles, are fundamental to our world.

String theory also posits that our universe must be composed of more spatial dimensions than we are able to perceive in our everyday world. To be exact, we would have to live in a ten-dimensional world (nine of space and one of time). It is interesting to note that a ten-dimensional universe and a world of nine spatial dimensions appear in the ancient Kabalistic and Hermetic traditions, respectively.[1,2] One of the most ancient references to space-time dimensions appears in the following quotation from the so-called *Emerald Tablets*:[3]

> *Nine are the interlocked dimensions and nine are the cycles of space. Nine are the diffusions of consciousness, and nine are the worlds within worlds . . . Space is filled with the concealed ones, for space is divided by time.*

Not only does this description of space-time jibe with that of string theory (e.g., nine dimensions of space and one of time), but also it refers to space as cycles—corroborating many ancient traditions that claim the entire manifested world is best understood as endlessly interacting cycles or patterns. In addition, this quotation suggests that all spatial dimensions are somehow interlocked and represent "worlds within worlds" that are both divided and concealed by time. If the six extra spatial dimensions of string theory truly exist, then phenomena we perceive in our familiar four-dimensional world are influenced by them. The presence of these unobservable spatial dimensions could definitely confound our interpreting cause-and-effect relationships solely via the intellect and five senses. Do higher dimensional "spaces" correspond to unrecognized—and currently unobservable—levels of Nature's hierarchy?

A difficulty that many physicists have with string theory is that the extra spatial dimensions (which some researchers equate with the ancient aether) and the fundamental strings exist at energy levels that preclude their investigation via empirical techniques. Hence, string theory is not yet testable and is sometimes labeled as philosophy, rather than as science. Recent observations of galaxies that appear as a sequence of double images and quasars that exhibit oscillating brightness may represent the first indirect evidence of strings—but only time will tell.[4] Whether or not strings and zero-point energies

emerge as true indicators of the etheric or akashic realm, there is no doubt that water will continue to be associated with this realm.

So, what is the relationship between aether and water? From a strictly scientific perspective, the question simply cannot be answered because, as yet, there no accepted description of aether. Postmodern naturalists and philosophers who delve into the highly controversial relationship between water and aether seem to gravitate toward an explanation involving mediation or transduction. In other words, water is understood to somehow bridge the energies of the two realms. The mechanism(s) by which water is able to perform this feat has never been elucidated; however, most unconventional hypotheses implicate the processes of sympathetic vibration or resonance.

There are a variety of controversial theories that postulate [1] the processes by which water downloads and stores etheric or akashic records, [2] the various ways in which water accesses and transduces information stored in various fields, [3] the behavior of water as an extended binary network that downloads information to the material world, and [4] the characterization of water as both a self-organizing and nonlinear system that exhibits coherence and intelligence. A review of these speculative theories and their applicability to water is presented in *Universal Water*.[5]

2. SOUND IN THE OCEANS

As a sound travels through an elastic medium such as water, a wave is created that imparts energy to the individual molecules—causing them to compress and then to relax along the path of the wave. Because the medium is elastic, the distance separating individual water molecules is permitted to vary just slightly, such that the propagation of sound may be defined as a periodic variation in pressure that is transmitted via adjacent molecules. Sound waves are *longitudinal*, such that water molecules move back and forth, or oscillate, in a direction that is parallel to the propagating wave.

The frequency of a sound wave is determined by the number of waves passing a given point during a specific time period. The period of time over which waves are normally counted is one second; therefore, sound frequencies are expressed as cycles per second or

hertz (see Table APP-1). Low-pitched sounds generally travel farther through water than do high-pitched sounds when they are generated at similar intensities or energy levels. Sound emanating from a point source in water usually results in a three-dimensional wave form that spreads spherically through the medium.

TABLE APP-1. Listed below are the approximate ranges for both frequencies and intensity levels of common underwater sounds.[6, 7, 8]

SOUND SOURCE	FREQUENCY (hertz)	INTENSITY (decibels)*
Ship engines and propellers	10-5000	160-190
Navigation/profiling sonar	100-3000	180-230
Explosive devices	1000-17,000	190-260
Icebreaking/drilling operations	20-1000	100-150
Whale songs and moans	10-8000	120-190
Dolphin clicks and whistles	500-25,000	100-180
Cetacean echolocation	10,000-150,000	130-230
Lightning strikes/undersea volcanoes/earthquakes	0.1-20,000	up to 260

** Intensity levels are presented in the units of decibels relative to a reference pressure of one micropascal at a distance of one meter from the sound source. Sound levels are a function of distance from the source, frequency range, and various environmental factors.*

Not surprisingly, the underwater sounds most familiar to most people are those produced within the *sonic* range of humans (i.e., frequencies of 20 to 20,000 hertz); however, water also transmits waves of *ultrasonic* (greater than 20,000 hertz) and *infrasonic* (less than 20 hertz) frequencies. As an example, dolphins emit whistles at frequencies as high as 30,000 hertz and echolocation clicks as high as 300,000 hertz.[9] Obviously, the upper limit of hearing for dolphins far exceeds that for humans.

Man-made ultrasounds include signals for communication and guided waves for inspecting underwater pipelines. The moans of baleen whales are the most common source of biologically produced infrasound, which have been measured down to about 10 hertz. By contrast, a number of underwater events (e.g., sea ice cracking, volcanoes, earthquakes) produce infrasonic waves that propagate within seawater at frequencies of approximately 0.1 to 10 hertz. Common

anthropogenic sources of oceanic infrasound include shipping traffic and low frequency sonar.

The propagation of sounds in the ocean is a rather complex subject owing to differences in water density as a function of depth, latitude, temperature, salinity, stratification, bottom topography, and many other factors. Variations in seawater temperature, salinity, and pressure all contribute to changes in density that, in turn, affect all sound waves traveling through the media. Generally, sound is attenuated via the processes of *spreading* (proportional to the distance traveled), *reflection* (due to solid structures or to boundaries separating water of different densities), *scattering* (due to the presence of rough surfaces), *absorption* (conversion of acoustic to thermal energy), and *refraction* (deflection of sound waves from a straight path).[10]

As a result of the vertical stratification of oceans, sound behaves differently in turbulent shallow waters than it does in either mid-depth waters or waters immediately overlying the bottom. Sound transmission at the surface is highly dependent on local conditions, such as wind and precipitation, and is usually restricted to low-frequency sounds. By contrast, most of the ocean lies between shallow and bottom depths, where a relatively thick layer of seawater (i.e., the *sofar* channel) transmits sound waves with less attenuation than that encountered either shallower or deeper.

Worldwide interest in infrasound peaked with the recent ratification of a Comprehensive Test Ban Treaty, requiring global monitoring networks to detect nuclear testing in the Earth's oceans, atmosphere, and solid interior.[11] Aside from nuclear blasts, scientists have identified a growing list of very low-frequency oceanic sounds that researchers have yet to match with any known source. Scientists have not even determined whether some of these unidentified sounds emanate from biological, geological, or meteorological sources.

One of these unidentified sounds is known as *upsweep*, a tone of only a few hertz that was initially detected by the U.S. Navy and has subsequently been traced to a chain of seamounts in the eastern South Pacific, where it is believed to result from the reaction of hot lava with cold seawater. While the origin of *upsweep* may have been solved, the origin of *bio-duck* (a noise detected by sonar operators who thought it resembled the quack of a duck) remains a mystery. *Bio-duck* is so ubiquitous within the frequency range of 50 to 300

hertz that an algorithm was developed to detect and then to eliminate it as ambient underwater noise.[12] Based on its repetitive nature and relatively distinct periods, *bio-duck* has been tentatively ascribed to sounds generated by a widely-distributed whale species; however, this hypothesis remains untested.

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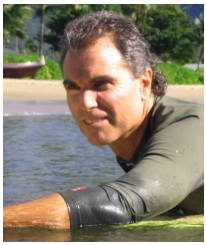

West Marrin, Ph.D., the author of ***Universal Water*** and scientific papers, addresses various water crises by analyzing perceptions of water in the postmodern world. He argues that, although we are understandably eager to solve our water problems, we are unlikely to do so while holding essentially the same views of water that contributed to the creation of such problems. Insights presented in this book can assist our decision-making around water in a way that informs new technologies, policies, and financial schemes.

Dr. Marrin is a scientist, naturalist and educator living on the Hawaiian Island of Kaua`i. His current activities include lecturing, teaching, and writing about water with the goal of expanding people's knowledge and awareness of its universal functions. He also consults with corporations, institutes, and nonprofits on projects involving the protection and restoration of water quality.