THE WISDOM OF BIOPHILIA— NATURE IN HEALING ENVIRONMENTS

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INTRODUCTION

Biophilia is defined as a love of the living world. We seek nature, especially when we don't feel well. Nature can calm us with a beautiful sunset or invigorate us with a spring rain. Both ancient and modern people use nature in healing. Nature has always offered healing places: a sacred spring, a reflective pond, a quiet grove, and majestic peaks. For centuries we have sought these sanctuaries in our quest for health and healing.

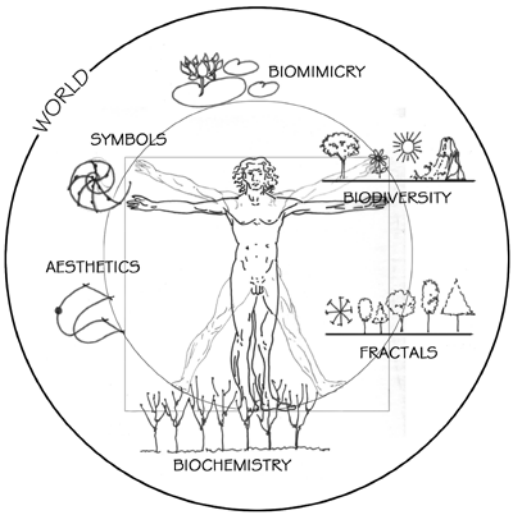
Hypocrites believed that the vital spirit provided the essence of life and natural healing ability. The word "disease" gets its meaning from "dis," meaning apart and "ease," meaning balance; dis-ease describes a loss of balance and harmony. Designing with nature can restore balance and harmony within the environment.

Nature is our guide to balance and harmony. Nature-based designs draw upon the innate intelligence found in nature—when plants turn their leaves to the sun for light, when a bird sits on eggs, and ultimately, when our body knows how to heal itself.

THE ROLE OF NATURE IN HEALING

What is it about nature that we find so appealing? Why do we enjoy the natural world? How is nature healing? To address these questions we look to the diverse sciences of biology, chemistry, computer science, environmental psychology and evolutionary anthropology, and neurosciences.

FIGURE 1. Figure of our oneness with the diverse natural world. (Illustration: Patricia Raimondeau)



Biophilia—including components of biomimicry, biodiversity, biochemistry, and fractals—holds the key to our love of nature.

Biophilia seeks to explain our love of nature through our natural evolution. Anthropology looks to our evolution from the African savannah to provide answers to these questions, specifically with prospect (our ability to see into the distance) and refuge (our sense of shelter or enclosure). Biomimicry suggests we look to how nature solves problems naturally. Biological science can provide evidence-based wisdom. Biochemistry addresses the chemical interaction of the natural world. Chemistry can help in understanding the key solutions of natural interactions between molecules. Biodiversity as seen from an environmentalist perspective helps us understand how the natural world works together. These are exciting diverse disciplines of research that can help contribute real solutions to the complexities of healing environments.

Biophilia has health benefits. Nature has restorative effects such as lowering blood pressure, contributing to a positive emotional state, lowering the levels of stress hormones, and boosting energy (Kaplan and Kaplan 1989).

According to a new study in the American Journal of Preventive Medicine, nature can have an impact on healing.

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"Although this is not hard-core medical advice, I think we can advise people to enjoy nature," says Howard Frumkin, MD, the author of the article. "There are a lot of indications that contact with nature, either walking in the wilderness, gardening, or having a pet, makes people feel better, and can minimize the effects of disease. It stands to reason that cancer patients may benefit a lot from some of those kinds of contact."

Nature has the added benefit of reminding people that humankind evolved in concert with nature, and that environmentalism is a necessity, not a luxury. Frumkin compiled research that suggests people can benefit from distinct types of encounters with nature: contact with animals, plants, natural landscapes, and the wilderness.

One study, for example, showed that prisoners whose cells faced a prison courtyard made about 25% more sick visits to healthcare facilities than did those who had a view of farmland. "Since we evolved in that environment, it would be surprising we would lose that affinity for it. It does make sense that some of our ancient preferences would still be with us," says Frumkin.

We evolved from the natural world, leaving behind caves and open savannah to move to man-made environments in which we control the elements. Our ancestors honored nature as a ubiquitous force in their lives. Nature provided shelter, clothing, food, light, heat, and water.

As we plan and design healthcare facilities, it is important to keep in mind the values we derive from the natural world. As we are mindful of these values, we form a strong bond with nature. This bond is biologically based and is especially important in the medical environment that often seems so harsh and barren of nature.

Incorporating the beauty of nature through aesthetics is a simple task. For example, we can add natural gardens, plants, and fish. The symbolic aspect of nature can also be useful. We can incorporate natural materials and organic design. Tapping into our natural curiosity, we can find ways to define nature within our design: we can add walking paths that identify the species of plants found along the way; we can provide the names of the local birds, and perhaps even provide samples of their calls. But we also want to be cautious of the fear of some aspects of nature. For example, we might want to avoid art that depicts animals that are menacing to some.

Our human value of nature offers many ways to include biophilia in our design. Designing with nature provides health benefits. According to Baker (2002), "a growing body of research suggests that this human affinity to nature—plants, animals, and landscapes—is something hard-wired into us. Scientists call it 'biophilia.'"

E.O. Wilson (1998) popularized the term "biophilia" as "the connection that human beings subconsciously seek with the rest of life." Barker reported links between nature—windows with views, companion animals, fish gazing, access to gardens—with positive health impacts. According to Ornstein and Sobel (1990), "Flooding our brains with rich natural visual stimulation helps us recover from surgery, tolerate pain, manage stress, and attain well-being." They also state, "Pictures of ponds, streams, trees, and other vegetation produce lower levels of arousal and higher alpha brain waves, a brain state associated with wakeful relaxation, than pictures of treeless urban streets." Longings for nature are therefore more than aesthetic preferences.

Several times a year I give workshops on healing environments. In these I lead "sensitivity exercises" that help listeners identify meaningful elements in their lives. In one particular exercise, I ask participants to imagine a special place that they enjoy more than others. I instruct them to list elements of this environment, focusing on factors that impact their senses. About 90% envision this place as an outdoor environment; the remainder describe their place as both indoors and outdoors.

The first time I posed this question, the response truly surprised me—interior designers made up the majority of listeners. (Designers make their living from the indoor environment.) I have given this workshop to consumers, designers, architects, and healthcare administrators—the response is always the same. People intuitively know that nature provides a meaningful and pleasurable part of our lives.

BIODIVERSITY

We marvel at the diversity of nature, from the ingenious way bees make honeycombs to the manner in which our earth regenerates itself. Biodiversity has inspired musicians, painters, sculptors, writers,

and other artists. We derive a great deal of value and pleasure from the diversity of nature. Nature walks—where we observe plants, interesting insects, birds, and water views—fill us with peace. Many cultural groups, such as the Native Americans and Australia's Aboriginal people, view themselves as an integral part of the natural world and show respect for other living organisms.

The diversity of nature supports healing. Watching clouds float overhead, gazing out the window at a grove of trees, or seeing a serene sunset brings relaxation and pleasure. Fish gazing and bird watching can be great waiting-room sports. Given a choice, we prefer natural scenes to blank walls and lifeless vistas.

Ornstein and Sobel report, "What we see affects our recovery when we are stressed. After watching a ten-minute film on the blood and gore of disabling work accidents, viewers responded with increased anxiety, muscle tension, blood pressure, and skin conductance. However, if the stress-provoking film was followed by a ten-minute film of nature scenes—trees and water—the recovery from stress on all physiological measures was faster than if they watched a film of an urban scene." (1990)

Roger Ulrich (1984) conducted powerful research on patients' response to a room with a view. He reviewed 46 hospital charts of gallbladder-surgery patients. Half of the patients received rooms with a window looking to a small grove of trees, and the other half saw a brown brick wall. Their outcomes differed significantly. Patients with the view of trees spent less time in the hospital, were less upset, and required less pain medication. They also had fewer postoperative complications. Views do make a difference.

BIOMIMICRY

Nature is a wise teacher. We can look to her to solve many of our challenges in design for healthcare environments. Nature can help us understand the structure of color and how to create memorable color palettes. We only need to observe the natural world to see that nature is a wise teacher.

Artists have captured nature's beauty on the canvas. Photographers rush to capture her perfect light. Perfumeries seek out the delicate scent of the flower. Architects and designers mimic the natural forms. These elements of the natural world are mimicked to bring us delight.

Nature, however, can teach us more. Janine Benyus, biologist, shares some of the ways nature can teach us to solve some of healthcare's most complex problems, naturally:

> Nature runs on sunlight.
>
> Nature uses only the energy it needs.
>
> Nature fits form to function.
>
> Nature recycles everything.
>
> Nature rewards cooperation.
>
> Nature banks on diversity.
>
> Nature demands local expertise.
>
> Nature curbs excess from within.
>
> Nature taps the power of limits.
>
> (Benyus 1997, p. 7)

Recently, I attended a lecture presented by Benyus. She suggested we look to nature to solve technology and healthcare challenges; we might look to the electric eels to study extended battery life; the sea grouse with expandable skin, to see how we can create elastic materials; to bees to help us prepare for an emergency response system; and termites that keep their habitat at 87 degrees naturally.

Our design of High Point Regional Cancer Center captured the philosophy of biomimicry in many diverse ways. Early in the design process, we explored the cancer patient's needs to connect with nature. The concept was called, "Journeys and Pathways," in that cancer treatment is a journey, not a dead end road. Nature, with her gentle curves, color palettes, forms, and details became our design inspiration.

The lobby mimicked the natural shore complete with water creatures embedded in the terrazzo flooring. Fiber optic lighting twinkled in the dome overhead, reminiscent of a clear night sky. The delightful reminders of nature were incorporated in every area starting in the lobby, moving to treatment areas with access to natural gardens, and then to radiation oncology, which incorporated back-lighted photo images of nature.

Biomimicry is not just symbolic. We can incorporate many biomimicry aspects into our design by

FIGURE 2. High Point Cancer Center Lobby uses the philosophy of biomimicry in the "Journeys and Pathways" concept. (Photography: Peter Brentlinger)

using natural products to help solve complex healthcare issues. The "Lotus Effect" is a good example of nature teaching us how to solve the infection control issues that are of such concern in the healthcare environment. Lotus plants grow in muddy rivers and lakes, and yet the leaves and flowers remain clean. Botanists wondered why. In 1975, two botanists, Drs. Barthlott and Neinhuis from the University of Bonn, discovered how the plants did this—they explained the Lotus Effect:

The plant has two unusual physical characteristics: microstructures that repel water and nanostructures found on top of the microstructures that are made of waxy materials. Wax does not absorb water.

"Lotus plants have super hydrophobic surfaces: water droplets falling onto them bead up and, if the surface slopes slightly, will roll off. As a result, the surfaces stay dry even during a heavy shower. What's more, the droplets pick up small particles of dirt as they roll, so that the lotus leaves are self-cleaning" (Kalaugher nanotechweb.org). BASF is currently working on a spray that will retain the lotus effect. Potentially, this material can be easily cleaned without toxic chemicals (Kalaugher 2002).

Just this year, I have seen numerous new healthcare products, such as textiles, hardware, and seating that use nanotechnology to mitigate bacteria on contact. By mimicking nature, we can provide better environments.

Nature is the translator, for what is beautiful in nature is actually what is good for us. Look at the appeal of sparkling water. Why do we enjoy it? The movement on the water's surface indicates abundant oxygen, meaning the water is safe to drink. Can we responsibly bring the beauty of nature into healthcare facilities and help solve complex issues while enjoying the appeal of nature?

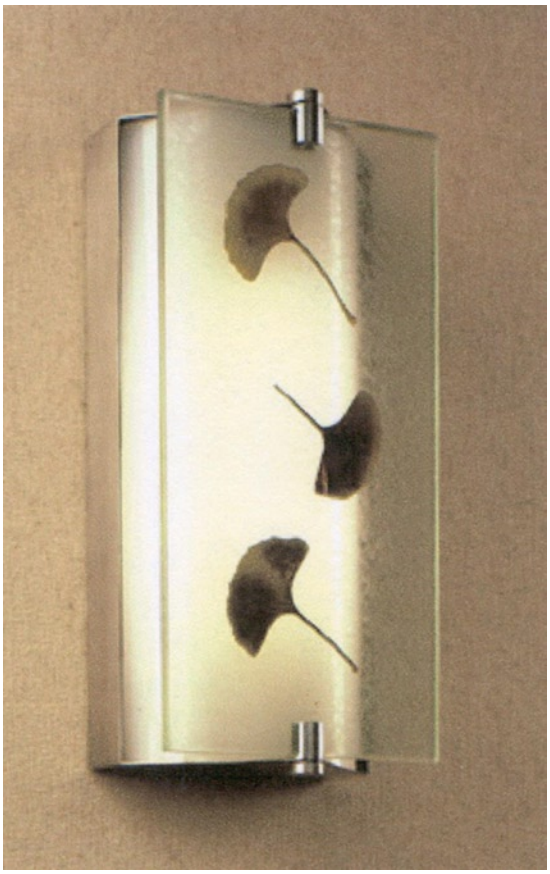
BIOCHEMISTRY

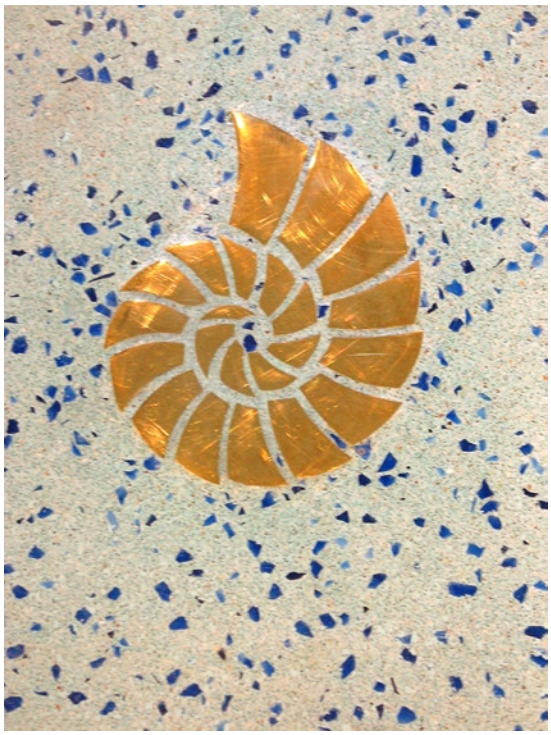
We cannot consider a healing environment without considering sustainable green design. In the ideal condition, green design would have no negative impact on our environment, would use only renewable resources, and all materials would be recycled. In addition, the environment would support health and well-being.

Economic, social, and environmental factors often seem to clash in the healthcare environment. However, healthy people are not possible without healthy facilities. Today, our culture spends 80 to 90 percent of time within the built environment. Often, the very building in which we seek healing makes us sick. Building Related Illness (BRI) is the condition that links diseases such as cancers, respiratory diseases, allergies, and asthma to building environments (Bonda 2007). Improving the indoor environmental quality improves the health of the patients, their families, and staff. Toxicity, dangerous materials, finishes, glues, adhesives, off gassing, PVCs, toxic cleaning agents, and people with sensitivities and allergies are just a few of the chemical challenges faced by healthcare facilities.

The Green Guide for Health Care (GGHC) is an organization that provides a "toolkit" for quantifying and integrating sustainable design for healthcare facilities. The GGHC promotes best-practices within the healthcare environment.

FIGURE 3. Details representing the natural environment were used throughout the design. (Photography: Joseph Parimucha)





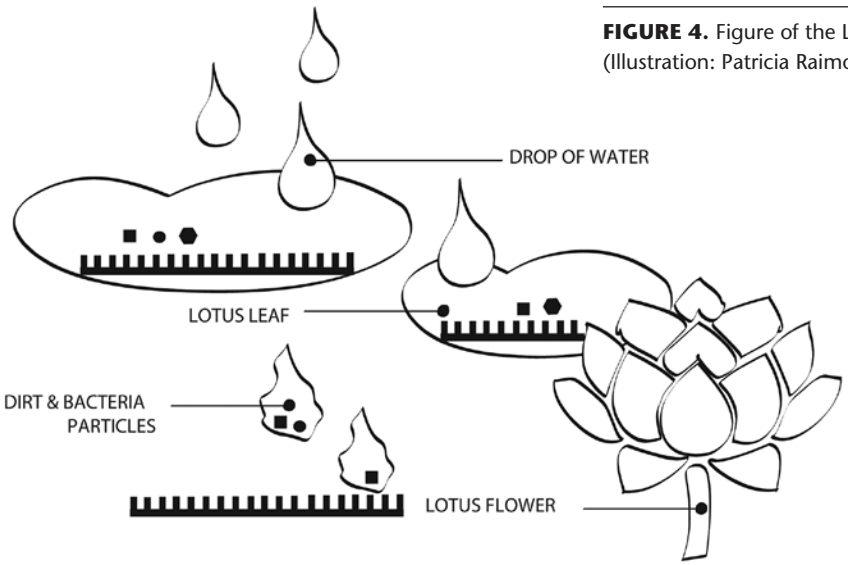


FIGURE 4. Figure of the Lotus self-cleaning effect. (Illustration: Patricia Raimondeau)

Robin Guenther of Guenther 5 Architects is a healthcare architect. She is also an early pioneer in bridging the challenges of the healthcare environment with sustainability and green design. Robin says, "I believe that architects and their consultant teams have a responsibility to broker a better relationship between clients, the patient, and the environment. This means introducing alternative energy sources, choosing sustainable sites, introducing connections to nature, and then tracking these issues through construction and watching the building's environmental service record, on-going operations, waste overhaul, and such. I'm not suggesting a paper trail, just a more thorough understanding of how hospital organizations 'think.'" Robin has a new book coming out this year, *Sustainable Healthcare Design,* which promises a standard for green healthcare design.

FRACTALS

Observe the beautiful geometry of a single snowflake under a microscope and then view millions of these beauties in the fields of new fallen snow. Observe a single maple leaf in the fall with its brilliant color and then see that leaf drop to the forest floor with many other leaves partially decomposed and crushed underfoot. What we observe is the natural beauty and scalability of fractals.

Fractals are the organizational systems of nature, based on geometry and mathematics. Fractal order arises from the interplay of physical and biological dynamic process, and fractal design is the basis of organic architecture.

The term "organic architecture" was first used by Frank Lloyd Wright who emphasized natural forms and shapes. Today, organic architects such as Frank Gehry, with the help of sophisticated software and computers, have created beautiful complex structures using fractal principles.

Fractal design reaches far beyond a design gimmick; it is an essential foundation of art and design. In healthcare design, fractals can be sensitively employed to create pleasing, elegant, lasting, and natural healing environments. "Fractal order arises from the interplay of physical and biological dynamic process. It is in a sense, a kind of a snapshot of natural events that have occurred in a particular environment over time" (Wise 2002).

Fractals are nature's patterning. In nature, wind, water, flora, and fauna group together. They look similar, but each is different. Scale is an important part of fractals, as fractal designs give a visual perception of what we cannot totally see, such as small branches from a tree expressing the great oak tree.

The mathematics of fractals is rooted in Euclidean geometry, a power-law relationship that represents pure points, lines, planes, and solids. However, nature does not obey our mathematical order. Instead, natural fractals occupy space between dimensionalities such as clouds, ripples on the pond, or the outline of trees on the horizon. Perceptual research finds most people visually prefer fractal forms, more than grids and checkerboards (Wise 2002). According to Wise (2002), "This innate preference for lower fractal dimensionality may also underlie the finding by interiors researcher Patricia Roddemann that in general, the 'busier' floral wallpaper patterns become, the less people like them."

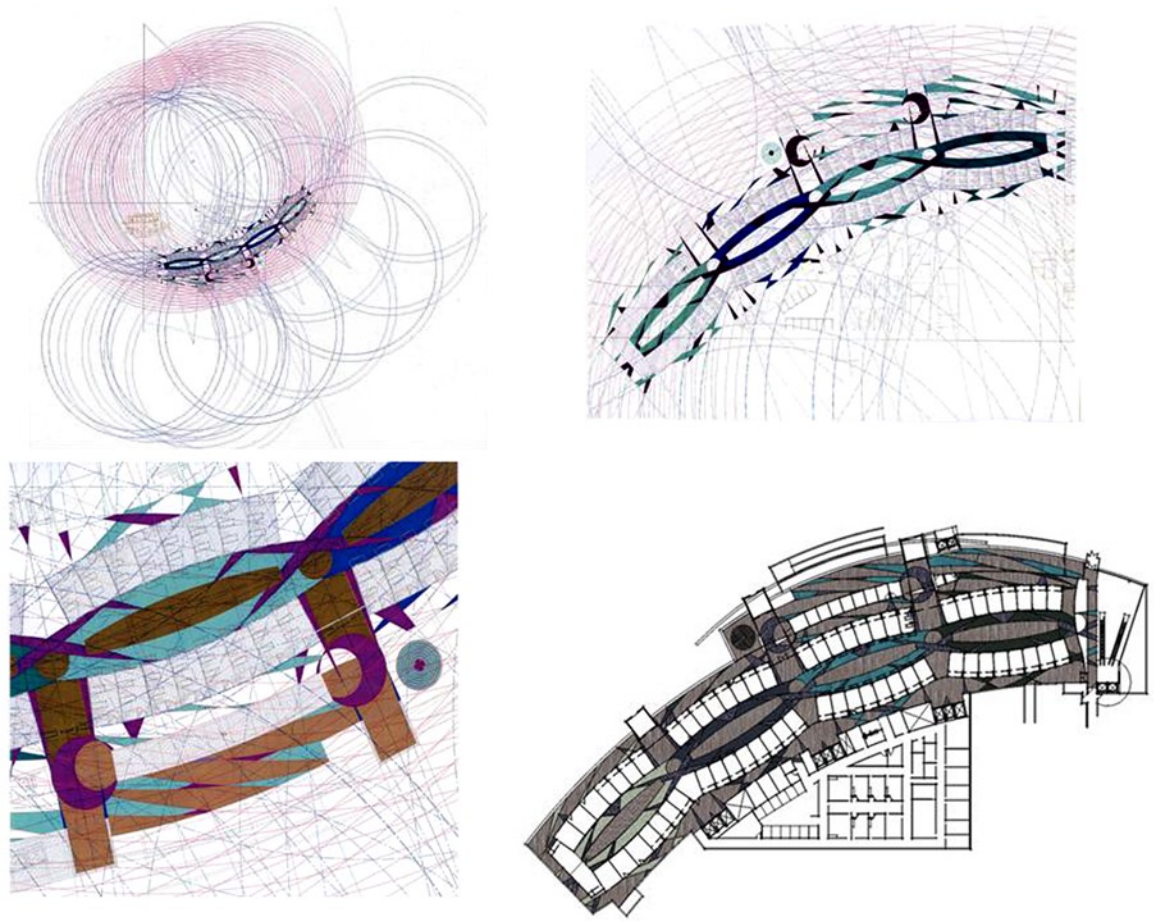
Organic design has long been the cornerstone of healthcare design practice. Long before I knew about fractals and the principles of designing with nature, our interiors embraced natural forms, shapes, curves, and patterning intuitively. Today, we now plan for the patient experience with organic pathways that aid in wayfinding, such as curved walls, bulkheads, and natural patterning.

One of my favorite fractal designs was the one we developed for ER One, the nation's emergency preparedness center for the Washington, DC area. The architects, HKS Dallas, developed a beautiful curved footprint for the site. Our interiors team took the footprint's outer walls and extended them until we found the point where they converged. From this point, we were able to find arcs from points of the exterior wall, which related to the building's gentle curve. We continued to develop the arcs, and this formed a seemingly abstract organic form directly related to the building's architectural form. We developed an organic floor pattern to be executed in terrazzo that sublimely ties the building's form to nature.

ANCIENT NATURAL PHILOSOPHIES

Ancient cultures of Chinese, Sanskrit, Aboriginal populations, and our own Native Americans have long integrated nature into healing.

FIGURE 5. Proposed floor patterning for ER One at Washington Hospital, Washington, DC. (Illustration: Angela Tilghman)



Water evaporates and it rains down to nourish the wood elements—trees and vegetation. We cut trees and use wood to feed fires. Fire is energy at the center of the earth; when earth expels this energy, it reduces matter to ash creating more earth. Earth produces minerals to create metal. Minerals from metal elements contribute to mineral water, and the cycle continues.

The philosophy of Feng Shui seeks to balance the cycle of natural elements for a nourishing environment. Although we live in a man-made environment, cues taken from Feng Shui may successfully balance natural and man-made environments to create healing environments.

The Zen philosophy stresses the relationship between people and nature. According to Lee (2002), "Ideally, we should constantly be in touch with our outdoor surroundings, the changing face of nature, and the simple pleasures and experiences provided by the wind, sun, and rain." Zen gardens provide a place of solitude and relaxation where the body, mind, and spirit can achieve harmony. The Zen garden has three main components: a ladle and water for cleansing, a lantern symbolizing the guiding light along life's pathway, and stepping stones providing a pathway through which the energy of Chi may pass. Healing environments may incorporate Zen's simplicity and symbols.

Native Americans stressed development of the inner life, which was reflected in the natural world: "When the clouds of devastation drop fire, we will be with you." "A pair of golden eagles flew over, and

again the children's grandfather felt good." "The snake children looked at each other with excitement." "Remember the spider." "Fear is his tool." "Mole has tunnels that will take you where you want to go." "Transform yourself into an otter and slide through those tunnels." These quotes are part of ritualistic storytelling essential to Native American culture.

Nature, spirituality, and healing are inseparable in this culture. The events of the natural world spoke to inner healing processes for the person. Telling of a burning fire on the mountain, speaks of the person who is in agony. With awareness comes help to alleviate the agony. Rain comes to quench the fire. These natural events are perceived as related. The fire and the rain were messages about the internal healing process. Such healing concepts are consistent in the Native American healing process (Mehl-Madrona 2003).

The Aboriginal people of Australia are also one with nature in all aspects of life. Like the Native Americans, health is not taken out of their spirituality and nature context. In April 2006, I visited Australia representing Austrade of the Australian Embassy. My responsibility was to visit artists and art communities to see what might be imported to the United States. I found the Australian art typically to be very Western-with the exception of the highly complex and beautiful Aboriginal art. Each painting told a story of family, relationships, spirituality, and healing all within the context of the natural world. What strikes me in both of these cultures is that the human experience is not *in* nature but recognized *as* nature.

An art and art program provides the designer with an opportunity to symbolically integrate nature into the healthcare environment. The arts can be a positive distraction for the stressful places in healthcare environments.

Roger Ulrich did a research study on the use of art in a cardiac intensive care unit to determine if art with views of nature had a positive impact on medical outcomes. Artwork with views of nature was shown to one group, versus no artwork for the control group. The results indicated outcomes of less anxiety and lower doses of pain medication from those exposed to the artwork of nature. The study further showed that patients had less favorable outcomes against the control group that was shown abstract art with strong rectangular forms (Ulrich 1993).

I am continually surprised at how much inappropriate art is used in major medical centers. I have seen not only abstract art but art that looks violent, angry, and confusing. Art should be carefully selected to be pleasant, friendly, and consisting of nature scenes. Art should not contain any forms of violence or perceived violence. Violent water, a threatening sky, dark woods, a lonely house—these are subjective matters that should be avoided. Even an image of a big dog sleeping in the sun can generate fear.

This caution does not mean that art should be bland and boring. A good example of a successful art program is our recently completed project based on the Potomac River. The Potomac River hospital took its name from the neighboring river that could be seen from campus. The entire art program focused on the nature of the river, relating it to the architecture, wayfinding program, and the interior design.

Art and sculpture became meaningful landmarks. In order for art to be meaningful, it must be represented with strong and familiar icons. This enables the visitor to identify with the subject matter. When art is located in such a way that it identifies a story or communicates a theme, it further strengthens the bond. Themed art must relate to the needs of the occupants. Unique themes tell different stories and intuitively provide a different meaning to each floor. Diversifying art by floor avoids confusion as to what floor the visitor is on.

Potomac Hospital's art program portrays familiar landmarks of the region. For example, the theme for the intensive-care/critical-care floor reflects the nature of the river, using artwork, sculpture, and design elements to support the designed environment. Nature along the banks of the Potomac River provides an appropriate and soothing background for the sickest of patients.

The oncology floor embraces the "four-seasons" theme, which symbolically expresses transition, journey, and hope. The medical surgical floor uses building elements found on the banks of the Potomac—bridges, buildings, and lighthouses. The main floor of public space provides a colorful and

FIGURE 6. The art program at Potomac Hospital embraces the "four-seasons" theme through the use of color and artwork. (Photography: Joseph Parimucha)

upbeat theme of boats. The pediatric department follows a life-under-the-river theme with a sunken ship and underwater creatures that identify children's rooms, signage, and wayfinding cues. Each floor uniquely creates a sense of place with which the visitor can identify.

The art program comes together on a long corridor connecting the existing and new building. A graphic wall illustrates the story of the Potomac River on a 60' wall map, colorfully illustrating the art, nature, and history of the river. This introduces visitors to the delightful art and journey they would find within the building. Everyone remembers this major landmark. It provides a strong connection with the community landmark, helps make sense of the pathways of the building, provides information, as well as delights with positive distractions.

THE CYCLES OF NATURE

Nature has constant cycle-tides: day and night, the four seasons. Seasonal cycles indicate change; we change our wardrobes and our social and religious activities. Most of us notice the sun's cycle, although we no longer depend on it to dictate our day's activities. Our man-made environment shields us from the sun's position in the sky, and the moon's phase attracts the notice of few. Our relationship with the cycles of nature is weak, and we are loosing our connection with our natural world.

Healing environments can incorporate cycles of nature. Patients need to look out windows and observe what geographical direction they face. Patients and staff need access to outdoor areas, and they should be encouraged to engage in outdoor activities. To embrace nature, our designs should change seasonally, incorporating the colors, foods, smells, and sounds of the season. Design makes best use of the sun's direction. Put the breakfast areas in rooms with eastern exposure so that visitors can enjoy the morning sun. By rekindling our relationship with the cycles of nature we can promote mental and physical well-being—and a healing environment.

FIGURE 7. "Potomac the River Speaks" brings the familiar setting of the Potomac River indoors. (Photography: Joseph Parimucha)

SUNLIGHT

Sunlight boosts our emotions and moods. We enjoy the feel of it even when we know that harmful rays cause cellular damage. According to Liberman (1992), "The decreased exposure to sunlight causes

a high incident of irritability, fatigue, illness, insomnia, depression, alcoholism, and suicide. Interestingly, it has been found that in Finland more children are conceived during the months of June and July, when the sun shines approximately 20 hours per day, than during the winter months."

As sunlight passes from the eye to the brain, it affects the entire body—from the spine to the pituitary gland, which depends on light for growth. All color is light, light is energy, and energy affects every cell of the body. For centuries, scientists have known that people depend on sun for physical well-being. The sun catalyzes many metabolic processes, and when we lack exposure to sunlight, some metabolic pathways sit dormant, reducing our ability to burn fat and expel toxins. The research of photo biologist John Otts suggests that only light containing the full wavelength spectrum of natural sunlight can maintain health. He contends that poor light poses a serious threat (Liberman 1992).

Most healthcare environments rely entirely on artificial light, cutting us off from sun and seasons and separating us from natural cycles. Medical facilities often evolve over years, adding layers of buildings to already dense building masses. This creates a tomb-like quality—people working in center cores never see natural light or outside elements.

Healing designs maximize daylight exposure. Northern facilities need to be particularly attentive to this need. An important consideration for all facilities includes a natural light plan early in the initial design process. Updating master plans should also keep the need for natural light in mind.

Respite areas need to be considered and be included to accommodate staff who must work in areas that lack exposure to natural light. Designs should include cafeterias with windows and provide the best possible views.

Augusta Medical Center in Fishersville, Virginia, lies in the Shenandoah Valley. It recently opened a new hospital; the dining room has the best view in the house. Architect Joe Parimucha fought to get dining rooms out of the basement and up on the roof. Traditional medical facilities locate the cafeteria in the basement because of its proximity to loading docks, kitchens, and storage areas. Parimucha initiated a study to split the services between the basement kitchen and the roof dining room. The facility found they needed only three additional staff to accommodate the change. Parimucha believed that the benefits to health and morale outweighed the cost of the additional staff, and this proved correct. The hospital administrator reported a decreased turnover rate in cafeteria staff and improved employee satisfaction, especially for employees working in areas without windows.

DESIGNING WITH PLANTS AND FLOWERS

The relationship with plants is a powerful connection with life. Venolia and Dadd (1988) state that caring for plants "releases us from our mental ruts, physical tensions, and sense of alienation; we become meaningful to our plants' flourishing, as they do to ours." Healing environments should incorporate this flexible tool.

Green plants effectively purify the environment, absorbing carbon dioxide and releasing oxygen. They release moisture, preventing aridity. Plants filter toxins and other pollutants caused by cigarette smoke and chemical cleaners.

Whatley and Donaldson (2002) state that, "The best purifying plants to include in your space are gerberas, moth orchids, tulips, cyclamens, chrysanthemums, peace lilies, areca palms, spider plants, bamboo palms, and rubber plants."

The more we seal up our buildings to save energy, the staler the air becomes. Airtight buildings with double-glazed and inoperable windows provide low-quality environments, and healing environments require high-quality air. Designing with plants is one of the easiest ways to support healing in a man-made environment. They accent any design or style. One of my clients uses a florist to keep major fresh arrangements in a few areas of the hospital, which has been budgeted into the building-maintenance operations. Carl Ackerman, the building engineer of Potomac Hospital, reviews the budget each year but never touches the plant budget. He reports that the flower arrangements receive more compliments than any other amenity, saying, "No, they are not necessary, but people notice that we care."

THE GARDEN

A garden can bring all natural elements together allowing us to interact directly with nature. A garden is a green or colorful living space. With variations in color, size, shape, and location, those seeking to design a healing environment find that gardens provide a versatile tool.

My husband and I had a unique opportunity to spend a day with Clare Cooper Marcus while she searched the Washington, DC area for healing gardens. A professor of landscape architecture at the University of California, Berkley, she is also the principal of Healing Landscapes. She was recovering from a life-threatening disease while in the midst of writing her book, "Healing Gardens." We discovered that few healthcare facilities offered gardens, and of those gardens, fewer still had appropriate amenities.

Marcus (1999) states, "Gardens can be healing and restorative via a number of mechanisms. The most obvious is the aesthetic of nature; that is, creating a beautiful, verdant place that will be a powerful enticement to go outdoors. Being outdoors in a natural or quasi-natural setting, experiencing sunlight, viewing trees, and listening to the sounds of water or birdsong—the combination of these and other elements that make up a garden can have a measurable stress-reducing benefit."

She lists some benefits that gardens bring to healthcare facilities:

- Stress reduction for visitors and staff
- Reduction of depression, especially when connected with physical activity
- Higher quality of life
- Reduction of pain
- Improved wayfinding
- Reduction in provider cost, i.e., less use of medication and shorter lengths of stay
- Increased patient mobility
- Increased patient satisfaction
- Increased staff job satisfaction

NATURAL FINISH MATERIALS

Finish materials and furnishings can introduce elements of nature and promote a healing environment. Wood is a favored element as people love wood and respond positively to it. In selecting furniture for offices, people will primarily select wood over any other material. Most even prefer fake wood over materials like plastics, metals, glass, and even luxury stone materials.

Wood floors with linear planks can provide an expansive look. Used on ceilings, wood creates interest and a cozy feeling. We often combine a light-color floor, like maple, with dark cherry insets. This creates a light, airy space that sparkles with color and warmth. Today we use vinyl floors printed and embossed with a layer that emulates wood. Practical and beautiful, patients prefer these over carpet or standard vinyl floors.

Real wood is most appreciated in areas that we touch, such as hand railings, furniture, and wall details. When real wood is not practical for maintenance and durability reasons, furniture and wall details can incorporate small wood accents. Wood furniture with laminate or stone tops is beautiful and durable. Wood handrails can be used with acrovyn (high impact vinyl) bull-nose bumper guards.

Elements from trees, especially leaves, make wonderful decorative motifs for floor, ceiling, and wall design. Armstrong and USG both offer wonderful ceiling tiles with leaf patterns. Natural icons provide a calming and interesting point-of-focus, especially for patients in a compromised position, such as an exam table, procedure table, or dentist chair.

HEALING NATURE OF WATER

One cannot discuss the healing aspect of nature without emphasis on water. Water makes up 71% of the earth. Life simply cannot exist without water. Our bodies are made up of 75% water. Our survival is dependent on having accesses to water. Wars have been fought over access to water; civilizations have grown up and crumbled because of the source of water. Water is essential to life. We think of water in nature as being rivers, lakes, and ponds, but it is also rain, ice, and snow. Rain droplets mixed with sunshine give us a rainbow, the symbol of hope. Water infiltrates the ground and it gives us wells and springs.

Water has been linked with cleanliness and good hygiene since the time of Hypocrites, who connected

medicine to science by linking good hygiene to the prevention of disease. The word hygiene takes its name from the goddess Hygiea (770 B.C.). Water is considered a purifier in most religions. Today, water, washing of hands, cleanliness, and scrubbing before a medical procedure is still critical in prevention of infection and disease.

Baths, spas, and medicinal healing have long linked water with healing. From prehistory's healing springs to modern day health spas, water and cleanliness have improved general health conditions (Croutier 1994). Today medical spas are undergoing a revival as people are not only seeking alternative health practices but also reaching for solace that the spa experience can provide. Spa in the true sense implies a balancing of the mind, body, and spirit through their interaction with water. Spas are popping up all over in shopping centers, beauty salons, cruise ships, and hotel chains. You can even purchase a build-it-yourself spa at your local "Home Depot."

Is this a popular fad, or does the spa water truly have value? The balance created by water provides a holistic atmosphere, not just pampering. This is similar to the early Aesculapius Centers. Why do spas work? A French physician, Deslois-Paoli, replies, "We really don't know. There are two principle hypotheses. One is the effect of the waters themselves; the other is admittedly the psychosomatic effect" (Croutier 1994 p.169).

Water is an element of nature that also delights. We are attracted to the sound of water, its gentle trickle, its bubbling or waves lapping at the shore. It is said to have a calming effect and feeling of regeneration of the spirit. Biophilia is at work—we are simply attracted to water—and for this reason water features have often been a focal point of healthcare facilities.

CONCLUSION

Designing with nature, biophilic designs are an important consideration for healthcare facilities. They are powerful and appreciated by the patient, staff, and families. As we have seen, strong evidence suggests we like to have nature around us. Our challenge is to design using biophilic design features that satisfy our love of nature, and thereby support the healing process.

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