

THE HEALING CODE OF NATURE

Discovering the
New Science of
Eco-Psychosomatics

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Translated by Victoria Goodrich Graham

*Der Heilungscode der Natur
Die verborgenen Kräfte von Pflanzen und Tieren entdecken*



sounds true
BOULDER, COLORADO

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THE MYSTERY OF TREES



What Do Trees Have to Do with Our Health?

When I was writing this book, my little son, Jonas, was in the hospital, and I was at his side as his caregiver. We shared a room at the university clinic for pediatrics in my former hometown of Graz in the south of Austria. The inpatient treatment lasted several weeks and was associated with numerous hardships for my little patient, who was then only seventeen months old. At times they pricked his finger every day to draw blood, and during the night, he was often attached to an IV for hours or connected with wires to medical devices. The long hospital stay and the constant uncertainty of how long it was going to last drained my strength, as well as that of my son. But around the clinic there was something that brightened our mood and helped us to not lose courage: a vast forest. The pediatric clinic, which lay directly on the edge of the forest, was literally embedded in a woodland landscape.

Every day, as soon as we went outside through the ground-floor entrance, Jonas started to kick his legs and laugh in his baby carriage, full of joyful anticipation. We had discovered a narrow path off the main route in the forest at the beginning of our stay. Right around the first bend, we were greeted by an old beech tree with a thick, silver-gray

trunk. Every time we passed it, Jonas followed the trunk up to the top with his gaze. Above our heads, the beech spread its branches into a mighty crown. It was autumn, and the foliage shone in intense colors of red and yellow. We roamed through the thicket and picked the last berries of the year from twisting, thorny plants. We watched deer and squirrels. Once we even saw a fox.

I was impressed how every day something new in this forest fascinated my little boy, so even after his exhausting experiences in the hospital, he could still laugh out loud with me in nature. I am sure the regular breaks in the woods helped my son gain some distance from the daily hospital routine and allowed him to process stressful experiences more easily, thereby saving his psyche from deeper scarring.

I felt how the forest had the same effect on me. I returned from the woodland with renewed strength every time. We definitely would have been worse off in a hospital surrounded by concrete and without any green space. Other patients I met in the woods talked about the same beneficial effects they experienced there. The nurses, doctors, and psychologists also used the forest during their breaks or after work to take a step back from their often stressful jobs. One oncologist, who daily treats children with cancer, told me that her evening walks in the woods helped her to deal with her own feelings of sadness, which are as much a part of her profession as happiness after successful treatments.

Even for patients who cannot leave the hospital, the environment is extremely important. Environmental scientist Rachel Kaplan at the University of Michigan found in a scientific investigation that even glancing briefly through the window at trees or green areas relieves and relaxes us in stress situations. I experienced this phenomenon in the clinic as well. From my son's room, we could see through the window over the crown of the forest. Again and again I caught a soothing glimpse of it, which gave me the opportunity to "escape" our turbulent life in the hospital and take a deep breath. This also made me look forward to our next opportunity to visit the forest; its broad, leafy canopy symbolized the "world out there" and the prospect of leaving the daily hospital routine behind me. A cement wall would not have had the same effect.

Scientists have been comparing the effects of trees versus brick walls near hospitals for more than thirty years. In April 1984, *Science*, one of the world's best-known scientific journals, published the results of a clinical trial that researchers conducted on a variety of patients over a number of years. Health-care design researcher Roger Ulrich, who teaches and researches as a professor at Swedish as well as US universities, demonstrated together with his colleagues that the mere view from a hospital window influences healing. The patients in the study all required routine gallbladder surgery. The treatment and accommodations were identical for all of them, with only one factor modified: Some of the patients could look out of the window at a tree, which Professor Ulrich referred to as the "tree group." The other patients looked through the hospital window at nothing but a brick wall. The results speak for themselves: The patients from the tree group were able to return home more quickly than those from the brick-wall group since wound healing and overall recovery were accelerated. They also needed significantly fewer, and lower-strength, painkillers.¹ Finally, there were even fewer postoperative complications in the tree group, although Ulrich explains that he considered this effect to be secondary and attributed it to the weaker pain medication causing fewer side effects.

While I was with my son in the hospital, I kept thinking about this study and was happy that we could not only see one tree but a whole forest when we looked out his window.

The way in which Professor Ulrich pursued his investigations corresponds to a research method with comparative groups that is frequently used in clinical trials. The scientists divide their patients into groups. They only change a single factor in each group, in this case "tree" or "brick wall." The effects of these variables were being tested. Ulrich's participants had no idea that the tree or brick wall in front of their windows was part of an experiment; in other words, they were "blind" to these variables. Then the researchers compared the two groups on average. What changes does the tree cause? What changes with the wall? In Ulrich's experiment, the physicians did not know that the trees and walls outside the windows had any meaning either.

They, too, were “blind” to it. This is called a “double-blind study.” In this way, researchers could rule out that the mere expectations of the patients had an unconscious influence on their healing or that the doctors accidentally behaved differently to the tree patients than the wall patients because of their own expectations.

These double-blind studies are the gold standard in medical research. They are also used in testing medicines. Each drug must be compared to a placebo with no active ingredient, and neither the doctors nor the patients usually know which pill has the active substance. As Ulrich’s study showed, the influence of plants on people’s health can also be determined by using such comparative studies. Group comparisons will continue to play an important role in this book as we take a closer look at the scientific background of nature-human medicine.

Since Ulrich’s tree studies, research has provided much more evidence that trees have a surprisingly positive effect on our health that goes far beyond the mere “feel-good effect.” Qing Li, a professor of medicine from the Nippon Medical School in Tokyo, and his research team analyzed statistical health data of the Japanese population and concluded that significantly fewer people died of cancer in forested areas than in areas with no forest. In this study, the scientists included all prefectures in Japan.²

This process is entirely different from clinical double-blind studies. Qing Li and his colleagues conducted an epidemiological study, which is the statistical study of the health status of large populations where the scientists do not directly examine their “patients” but instead access databases. Thus, they can capture and compare information from very large parts of the population. Through complex statistical procedures, Li’s team had to ensure that the variable “forest area” was at the center of their study. Epidemiologists use anonymous data from health authorities and health insurance funds. How often does a person visit doctors or have to go to the hospital? What are their diseases? What drugs do they need to take? Qing Li and his team were able to link the incidence of cancer to proximity to vegetation. Because they studied the entire country, it is clear that trees—both in the city and in the

country—reduce the risk of dying of cancer. Epidemiological studies are widely used in health sciences and are scientifically recognized. They are an excellent way of checking the healing powers of nature on large populations.

Marc Berman, an assistant professor of psychology at the University of Chicago with a focus on environmental neuroscience, went one step further. He not only evaluated health data, but also combined it with satellite images and tree mapping from Canada's largest metropolis, Toronto. This extensive epidemiological study involved a large team, and its results were reported online in 2015 by the renowned scientific journal *Nature*, published by Springer.³ It turned out that the city inhabitants' state of health improved as the number of trees around their neighborhoods increased. Berman showed that the more trees that grow near people living in urban areas, the lower the statistical risk those people have of suffering from heart disease, diabetes, hypertension, and other typical "lifestyle diseases." This study did not include parks and green spaces; the health effects were only from those trees that were part of the urban streets of Toronto, such as trees along avenues, shrubs along the roadside, and small traffic islands with trees in the big city traffic. Berman and his team recorded half a million urban trees. They also compared the medical effects of these trees with other influences on our health. This is when the trees' potential really became evident. According to Berman and his coworkers, ten additional trees around a block of homes would have the same effect on the inhabitants' health as being seven years younger. This means the healing effects of nature are by no means confined to forests, but can also be found in large cities.

In an interview with the *Toronto Star*, Faisal Moola, professor of forest ecology at the University of Toronto and a coauthor of the study, was very pleased that, once again, environmental factors were proved to play an important role in our health. This reality has been underestimated by political decision makers so far. He demanded more trees in Canada's major cities. Glenn De Baeremaeker, city councillor in Toronto, considered the tree study groundbreaking because "it's a pretty magical solution, for peanuts."⁴

Trees and Our Immune System: “We Need to Understand”

Berman was also enthusiastic about the results and speculated on how trees affect our health. “Is it that the trees are cleaning the air? Is it that they are encouraging people to go outside and exercise more? Or is it their aesthetic beauty? We need to understand that.”⁵

Berman was certainly not wrong when he thought about the air-purifying effect of the trees. Additionally, green elements in the city are surely a motivation for more outdoor activity, and almost everyone would agree on the aesthetic value of trees. Yet that is not enough to explain why more trees in the city make us feel years younger and protect us from common diseases. In order to *understand* the healing relationship between humans and trees, we first need to learn more about what the doctors from Tokyo have found out. These findings open up completely new approaches and directions of thought in our search for explanations for the healing effects of trees.

In Japan, public funds are available for research in nature-human medicine. The Japanese government also finances elaborate studies with expensive testing methods that run for many years. Doctors integrate contact with nature into therapies offered at public hospitals, and experts study the health aspects of trees and forests at medical universities.

The tradition of *shinrin-yoku* (“forest bathing”) goes back a long time in Japan’s folk medicine.⁶ North and South Korea also have the same tradition, but it’s called *sanrimyok* there. But forest bathing has its longest history in China and Taiwan and has been called *senlinyu* there for centuries. The largest official *senlinyu* resort is situated in the north of Taipei, the capital of Taiwan. Ancient knowledge about healing from nature is also found in Traditional Chinese Medicine. Numerous exercises from *qigong*, a meditative movement system that also contains elements of martial arts, are designed to “absorb the chi of nature” as Traditional Chinese Medicine puts it. These exercises are carried out mainly in forests or green areas with trees. Even the *qigong* masters of the past apparently knew that nature not only heals in the form of plant- and mineral-based pharmaceutical substances, but also by a person simply being present in a green

space and breathing. In qigong, absorbing the chi of nature is always associated with intense breathing techniques. Furthermore, naturopathic physicians in Japan not only translate the term *shinrin-yoku* as “forest bathing,” but also often as “inhaling the forest atmosphere.” This suggests that something must be in the forest air that medically affects us when inhaled.

In 2013 Qing Li published the results of several studies that he had conducted with Japanese, Korean, and Chinese scientists in previous years. They discovered that spending time in forests leads to changes in the human body, which are clearly detectable via blood tests and other medical evaluations. At this point, I am going to focus on only one example of these changes, namely, the effect of trees on the human immune system.

Qing Li and Tomoyuki Kawada, a physician in environmental medicine, tested their subjects’ blood before and after visits to a forest. They found that the forest activates and strengthens important components of the human immune system. Our immune system responds to even short walks in the forest. A whole day in the woods resulted in an almost 40 percent increase in natural killer cells in the subjects’ blood on average. Not only were there more of these important defense cells, but they were also much more active than before. The effect lasted for seven days. After spending two days in a forest, the participants’ blood contained 50 percent more killer cells than before, and the effect was still measurable thirty days later.⁷

The term “natural killer cells” does not exactly evoke the most pleasant associations. The warlike metaphors with which scientists describe the processes in our immune system sometimes trigger debates about whether such a choice of words is justified. Can biological processes be compared with war? There is often talk of “weapons” that our body uses against “invaders” (germs) and “enemies” (tumors). Some scientists fear that it might be a strain on patients to imagine their body as a battlefield. Others, on the other hand, believe that it encourages a fighting spirit when we get sick. Statistically speaking, patients with a fighting spirit mindset are more likely to survive serious illnesses than patients who feel powerless against the disease.⁸

Either way, the choice of words is not too far-fetched. The natural killer cells, which the human body produces more of in the forest, are responsible for rendering viruses in our body harmless. They keep the viruses in check until enough special antibodies have been formed that can kill all of them. In addition, the natural killer cells attack dangerous cells in our body that could mutate into malignant tumors. They therefore keep us healthy, protect us preventively against cancer, and are indispensable for healing in this disease.

A look at the way natural killer cells work against viruses and tumor cells makes the combative word selection from the textbooks of immunology even more apt. Natural killer cells are part of our innate immune system. That is, they are not special antibodies that only appear—and then attack—a particular virus after contact, for example a flu virus. The natural killer cells form in our bone marrow and are already active when we are born. They accompany us all our lives. A killer cell has the ability to recognize when a body cell is infected by a virus based on its surface structure. It then activates a process that immunologists call the “killing machine.”⁹ Since viruses cannot be directly attacked, the entire body cell has to be rendered harmless. Viruses inject their own genetic material into that of the cell, thereby causing the cell to reproduce new viruses “by default.” The killer cells deposit microscopically small granules on the surface of the infected cell. These granules contain proteins that penetrate the cell and initiate natural cell death. In other words, they force the cell to self-destruct, which also means the end of the virus.

Natural killer cells do the exact same thing to the very dangerous mutating cells that lead to cancer. Cancer always begins with one cell that should have died but didn't. It generates more immortal cells that begin to proliferate. Killer cells help if a cell does not want to die and constitutes a health hazard for humans. The granules and proteins required by the killer cells to do this are also called “anticancer proteins” because of their function.¹⁰

Qing Li and Tomoyuki Kawada found out that “Doctor Forest” not only gives rise to additional and more active killer cells, but also promotes the formation of these anticancer proteins. Subjects of the study had significantly more of them in their blood after spending time in

a forest. Simply being present in the forest can therefore support our natural mechanisms that are responsible for the defense against viruses and protect us from cancer or fight against existing tumors. It is clear that these effects are directly attributable to the forests because the researchers didn't note any positive changes in comparison groups that were in urban areas. The participants did not exercise in the forest, which could also have triggered the health-promoting effect; they were simply present in the forest.

Such studies are all about group comparisons, which I have already described as the gold standard of medical research. One group goes into the woods; the other goes into the city. There is only one catch when scientists send their patients directly into nature: in the case of a tree in front of a hospital window, researchers can conceal that it plays a central role in the experiment. For field studies in nature, however, it is very difficult to keep participants in the dark about what is being compared. A double-blind study, as I described it, is often not possible in this type of field study. However, researchers can create comparable conditions between the "city group" and the "nature group" and meet scientific requirements. All subjects must spend the same amount of time in nature or the city and be active in a comparable way. Most of the time, the scientists leading the study even ensure that all of them eat the same. Only the environment is different between the two groups.

By taking blood samples in nature, it is possible to combine field studies with laboratory tests. Natural killer cells and anticancer proteins of the immune system are often used by doctors as conclusive biomarkers. Therefore, we are also in line with scientific trends when we use these important parameters of our immune system in order to prove the beneficial effects of nature.

An accompanying study revealed an additional positive effect that trees have on the human immune system. Our body has "first-aid cells" that are designed to attack invading pathogens as quickly as possible while our body mobilizes other defenses. These first responders are called "neutrophils" and swim in the bloodstream. With the help of sticky substances, they are able to instantly attach themselves to the

inner walls of the blood vessels at any time and to pull themselves out of the bloodstream without being washed away. That way, they do not miss their target. They penetrate the body tissue and basically “eat” the intruders by absorbing and digesting them. We sometimes feel and see this process as an inflammation. After spending time in a forest, an increase can be detected in the sticky substances that first-aid cells use to pull themselves out of the bloodstream and eat pathogens.¹¹ This is further tangible evidence of the effectiveness of nature-human medicine.

In the case of ill health, spending time among trees does not constitute a substitute for adequate medical treatment but is rather a complementary measure. The term “complementary medicine” means that common medical treatments are *supplemented* by additional therapies, not used in competition with them. Nevertheless, when researching the healing effects of trees, we are dealing with a science that can draw on verifiable facts. Forest medicine is therefore “evidence-based,” as it is called in modern medical jargon.

For now, let us continue looking at the effects of trees on the human immune system—at the natural killer cells, the first-aid cells, and the anticancer proteins. *What* exactly strengthens them in the forest? In order to answer this key question, several teams of biologists, physicians, and psychologists headed to the most beautiful forest areas in Japan, including the Nagano Prefecture, where the 1998 Winter Olympics took place.

From Tree to Tree . . . and Our Cells Are Listening In

Equipped with measuring instruments, Tatsuro Ohira and Naoyuki Matsui from the Forestry and Forest Products Research Institute in the Japanese town of Tsukuba traversed the forests and documented exactly which substances they could detect in the air.

We all know how aromatic it smells under trees, yet the fragrance of woods, leaves, needles, and bark is much more than just odors in our nose. When we happily exclaim that “it smells so good in the forest,” many of us are unaware that trees do not just smell good, but