The Secret Life of Plants

A fascinating account of the physical, emotional, and spiritual relations between plants and man

Peter Tompkins and Christopher Bird

authors of Secrets of the Soil

"Once in a while you find a book that stuns you. Its scope leaves you breathless. This is such a book."
—John White, San Francisco Chronicle

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AND

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Introduction

Short of Aphrodite, there is nothing lovelier on this planet than a flower, nor more essential than a plant. The true matrix of human life is the greensward covering mother earth. Without green plants we would neither breathe nor eat. On the undersurface of every leaf a million movable lips are engaged in devouring carbon dioxide and expelling oxygen. All together, 25 million square miles of leaf surface are daily engaged in this miracle of photosynthesis, producing oxygen and food for man and beast.

Of the 375 billion tons of food we consume each year the bulk comes from plants, which synthesize it out of air and soil with the help of sunlight. The remainder comes from animal products, which in turn are derived from plants. All the food, drink, intoxicants, drugs and medicines that keep man alive and, if properly used, radiantly healthy are ours through the sweetness of photosynthesis. Sugar produces all our starches, fats, oils, waxes, cellulose. From crib to coffin, man relies on cellulose as the basis for his shelter, clothing, fuel, fibers, basketry, cordage, musical instruments, and the paper on which he scribbles his philosophy. The abundance of plants profitably used by man is indicated by nearly six hundred pages in Uphof's *Dictionary of Economic Plants.* Agriculture—as the economists agree—is the basis for a nation's wealth.

Instinctively aware of the aesthetic vibrations of plants, which are spiritually satisfying, human beings are happiest and most comfortable when living with flora. At birth, marriage, death, blossoms are prerequisites, as they are at mealtime or festivities. We give plants and flowers as tokens of love, of friendship, or homage, and of thanks for hospitality. Our houses are adorned with gardens, our cities with parks, our nations with national preserves. The first thing a woman does to make a room livable is to place a plant in it or a vase of fresh cut flowers. Most men, if pressed, might describe paradise, whether in heaven or on earth, as a garden filled with luxuriant orchids, uncut, frequented by a nymph or two.

Aristotle's dogma that plants have souls but no sensation lasted through the Middle Ages and into the eighteenth century, when Carl von Linné, grandfather of modern botany, declared that plants differ from animals and humans only in their lack of movement, a conceit which was shot down by the great nineteenth-century botanist Charles Darwin, who proved that every tendril has its power of independent movement. As Darwin put it, plants "acquire and display this power only when it is of some advantage to them."

At the beginning of the twentieth century a gifted Viennese biologist with the Gallic name of Raoul Francé put forth the idea, shocking to contemporary natural philosophers, that plants move their bodies as freely, easily, and gracefully as the most skilled animal or human, and that the only reason we don't appreciate the fact is that plants do so at a much slower pace than humans.

The roots of plants, said Francé, burrow inquiringly into the earth, the buds and twigs swing in definite circles, the leaves and blossoms bend and shiver with change, the tendrils circle questingly and reach out with ghostly arms to feel their surroundings. Man, said Francé, merely thinks plants motionless and feelingless because he will not take the time to watch them.

Poets and philosophers such as Johann Wolfgang von Goethe and Rudolf Steiner, who took the trouble to watch plants, discovered that they grow in opposite directions, partly burrowing into the ground as if attracted by gravity, partly shooting up into the air as if pulled by some form of antigravity, or levity.

Wormlike rootlets, which Darwin likened to a brain, burrow constantly downward with thin white threads, crowding themselves firmly into the soil, tasting it as they go. Small hollow chambers in which a ball of starch can rattle indicate to the root tips the direction of the pull of gravity.

When the earth is dry, the roots turn toward moister ground, finding their way into buried pipes, stretching, as in the case of the lowly alfalfa plant, as far as forty feet, developing an energy that can bore through concrete. No one has yet counted the roots of a tree, but a study of a single rye plant indicates a total of over 13 million rootlets with a combined length of 380 miles. On these rootlets of a rye plant are fine root hairs estimated to number some 14 billion with a total length of 6,600 miles, almost the distance from pole to pole.

As the special burrowing cells are worn out by contact with stones, pebbles, and large grains of sand, they are rapidly replaced, but when they reach a source of nourishment they die and are replaced by cells designed to dissolve mineral salts and collect the resulting elements. This basic nourishment is passed from cell to cell up through the plant, which constitutes a single unit of protoplasm, a watery or gelatinous substance considered the basis of physical life.

The root is thus a waterpump, with water acting as a universal solvent, raising elements from root to leaf, evaporating and falling back to earth to act once more as the medium for this chain of life. The leaves of an ordinary sunflower will transpire in a day as much water as a man perspires. On a hot day a single birch can absorb as much as four hundred quarts, exuding cooling moisture through its leaves.

No plant, says Francé, is without movement; all growth is a series of movements; plants are constantly preoccupied with bending, turning and quivering. He describes a summer day with thousands of polyplike arms reaching from a peaceful arbor, trembling, quivering in their eagerness for new support for the heavy stalk that grows behind them. When the tendril, which sweeps a full circle in sixty-seven minutes, finds a perch, within twenty seconds it starts to curve around the object, and within the hour has wound itself so firmly it is hard to tear away. The tendril then curls itself like a corkscrew and in so doing raises the vine to itself.

A climbing plant which needs a prop will creep toward the nearest support. Should this be shifted, the vine, within a few hours, will change its course into the new direction. Can the plant see the pole? Does it sense it in some unfathomed way? If a plant is growing between obstructions and cannot see a potential support it will unerringly grow toward a hidden support, avoiding the area where none exists.

Plants, says Francé, are capable of *intent:* they can stretch toward, or seek out, what they want in ways as mysterious as the most fantastic creations of romance.

Far from existing inertly, the inhabitants of the pasture—or what the ancient Hellenes called *botane*—appear to be able to perceive and to react to what is happening in their environment at a level of sophistication far surpassing that of humans.

The sundew plant will grasp at a fly with infallible accuracy, moving in just the right direction toward where the prey is to be found. Some parasitical plants can recognize the slightest trace of the odor of their victim, and will overcome all obstacles to crawl in its direction.

Plants seem to know which ants will steal their nectar, closing when these ants are about, opening only when there is enough dew on their stems to keep the ants from climbing. The more sophisticated acacia actually enlists the protective services of certain ants which it rewards with nectar in return for the ants' protection against other insects and herbivorous mammals.

Is it chance that plants grow into special shapes to adapt to the idiosyncrasies of insects which will pollinate them, luring these insects with special color and fragrance, rewarding them with their favorite nectar, devising extraordinary canals and floral machinery with which to ensnare a bee so as to release it through a trap door only when the pollination process is completed?

Is it really nothing but a reflex or coincidence that a plant such as the orchid *Trichoceros parviflorus* will grow its petals to imitate the female of a species of fly so exactly that the male attempts to mate with it and in so doing pollinates the orchid? Is it pure chance that night-blossoming flowers grow white the better to attract night moths and night-flying butterflies, emitting a stronger fragrance at dusk, or that the carrion lily develops the smell of rotting meat in areas where only flies abound, whereas flowers which rely on the wind to cross-pollinate the species do not waste energy on making themselves beautiful, fragrant or appealing to insects, but remain relatively unattractive?

To protect themselves plants develop thorns, a bitter taste, or gummy secretions that catch and kill unfriendly insects. The timorous *Mimosa pudica* has a mechanism which reacts whenever a beetle or an ant or a worm crawls up its stem toward its delicate leaves: as the intruder touches a spur the stem raises, the leaves fold up, and the assailant is either rolled off the branch by the unexpected movement or is obliged to draw back in fright.

Some plants, unable to find nitrogen in swampy land, obtain it by devouring living creatures. There are more than five hundred varieties of carnivorous plants, eating any kind of meat from insect to beef, using endlessly cunning methods to capture their prey, from tentacles to sticky hairs to funnel-like traps. The tentacles of carnivorous plants are not only mouths but stomachs raised on poles with which to seize and eat their prey, to digest both meat and blood, and leave nothing but a skeleton.

Insect-devouring sundews pay no attention to pebbles, bits of metal, or other foreign substances placed on their leaves, but are quick to sense the nourishment to be derived from a piece of meat. Darwin found that the sundew can be excited when a piece of thread is laid on it weighing no more than 1/78,000 of a grain. A tendril, which next to the rootlets constitutes the most sensitive portion of a plant, will bend if a piece of silk thread is laid across it weighing but .00025 of a gram.

The ingenuity of plants in devising forms of construction far exceeds that of human engineers. Man-made structures cannot match the supply strength of the long hollow tubes that support fantastic weights against terrific storms. A plant's use of fibers wrapped in spirals is a mechanism of great resistance against tearing not yet developed by human ingenuity. Cells elongate into sausages or flat ribbons locked one to the other to form almost unbreakable cords. As a tree grows upward it scientifically thickens to support the greater weight.

The Australian eucalyptus can raise its head on a slim trunk above the ground 480 feet, or as high as the Great Pyramid of Cheops, and certain walnuts can hold a harvest of 100,000 nuts. The Virginia knotweed can tie a sailor's knot which is put to such a strain when it dries that it snaps, hurling the seeds to germinate as far as possible from mother.

Plants are even sentient to orientation and to the future. Frontiersmen and hunters in the prairies of the Mississippi Valley discovered a sunflower plant, *Silphium laciniatum,* whose leaves accurately indicate the points of the compass. Indian licorice, or *Arbrus precatorius,* is so keenly sensitive to all forms of electrical and magnetic influences it is used as a weather plant. Botanists who first experimented with it in London's Kew Gardens found in it a means for predicting cyclones, hurricanes, tornadoes, earthquakes and volcanic eruptions.

So accurate are alpine flowers about the seasons, they know when spring is coming and bore their way up through lingering snowbanks, developing their own heat with which to melt the snow.

Plants which react so certainly, so variously, and so promptly to the outer world, must, says Francé, have some means of communicating with the outer world, something comparable or superior to our senses. Francé insists that plants are constantly observing and recording events and phenomena of which man—trapped in his anthropocentric view of the world, subjectively revealed to him through his five senses—knows nothing.

Whereas plants have been almost universally looked upon as senseless automata, they have now been found to be able to distinguish between sounds inaudible to the human ear and color wavelengths such as infrared and ultraviolet invisible to the human eye; they are specially sensitive to X-rays and to the high frequency of television.

The whole vegetal world, says Francé, lives responsive to the movement of the earth and its satellite moon, to the movement of the other planets of our solar system, and one day will be shown to be affected by the stars and other cosmic bodies in the universe.

As the external form of a plant is kept a unit and restored whenever part of it is destroyed, Francé assumes there must be some conscious entity supervising the entire form, some intelligence directing the plant, either from within, or from without.

Over half a century ago Francé, who believed plants to be possessed of all the attributes of living creatures including "the most violent reaction against abuse and the most ardent gratitude for favors," could have written a *Secret Life of Plants,* but what he had already put into print was either ignored by the establishment or considered heretically shocking. What shocked them most was his suggestion that the awareness of plants might originate in a supramaterial world of cosmic beings to which, long before the birth of Christ, the Hindu sages referred as "devas," and which, as fairies, elves, gnomes, sylphs and a host of other creatures, were a matter of direct vision and experience to clairvoyants among the Celts and other sensitives. The idea was considered by vegetal scientists to be as charmingly jejune as it was hopelessly romantic.

It has taken the startling discoveries of several scientific minds in the 1960s to bring the plant world sharply back to the attention of mankind. Even so there are skeptics who find it hard to believe that plants may at last be the bridesmaids at a marriage of physics and metaphysics.

Evidence now supports the vision of the poet and the philosopher that plants are living, breathing, communicating creatures, endowed with personality and the attributes of soul. It is only we, in our blindness, who have insisted on considering them automata. Most extraordinary, it now appears that plants may be ready, willing, and able to cooperate with humanity in the Herculean job of turning this planet back into a garden from the squalor and corruption of what England's pioneer ecologist William Cobbett would have called a "wen."

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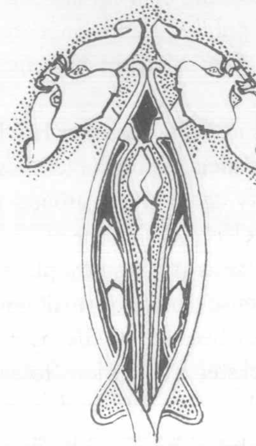

The dust-grimed window of the office building facing New York's Times Square reflected, as through a looking glass, an extraordinary corner of Wonderland. There was no White Rabbit with waistcoat and watch chain, only an elfin-eared fellow called Backster with a galvanometer and a house plant called *Dracaena massangeana.* The galvanometer was there because Cleve Backster was America's foremost lie-detector examiner; the dracaena because Backster's secretary felt the bare office should have a touch of green; Backster was there because of a fatal step taken in the 1960s which radically affected his life, and may equally affect the planet.

Backster's antics with his plants, headlined in the world press, became the subject of skits, cartoons, and lampoons; but the Pandora's box which he opened for science may never again be closed. Backster's discovery that plants appear to be sentient caused strong and varied reaction round the globe, despite the fact that Backster never claimed a discovery, only an uncovering of what has been known and forgotten. Wisely he chose to avoid publicity, and concentrated on establishing the absolute scientific bona fides of what has come to be known as the "Backster Effect."

The adventure started in 1966. Backster had been up all night in his school for polygraph examiners, where he teaches the art of lie detection to policemen and security agents from around the world. On impulse he decided to attach the electrodes of one of his lie detectors to the leaf of his dracaena. The dracaena is a tropical plant similar to a palm tree, with large leaves and a dense cluster of small flowers; it is known as the dragon tree (Latin *draco*) because of the popular myth that its resin yields dragon blood. Backster was curious to see if the leaf would be affected by water poured on its roots, and if so, how, and how soon.

As the plant thirstily sucked water up its stem, the galvanometer, to Backster's surprise, did not indicate less resistance, as might have been expected by the greater electrical conductivity of the moister plant. The pen on the graph paper, instead of trending upward, was trending downward, with a lot of sawtooth motion on the tracing.

A galvanometer is that part of a polygraph lie detector which, when attached to a human being by wires through which a weak current of electricity is run, will cause a needle to move, or a pen to make a tracing on a moving graph of paper, in response to mental images, or the slightest surges of human emotion. Invented at the end of the eighteenth century by a Viennese priest, Father Maximilian Hell, S.J., court astronomer to the Empress Maria Theresa, it was named after Luigi Galvani, the Italian physicist and physiologist who discovered "animal electricity." The galvanometer is now used in conjunction with an electrical circuit called a "Wheatstone bridge," in honor of the English physicist and inventor of the automatic telegraph, Sir Charles Wheatstone.