# In Context

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The Newsletter of **The Nature Institute**



#29

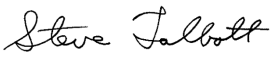
Dear Friends,

The Nature Institute was founded 15 years ago, in 1998. Four years later we moved into the building in which we have since carried out ongoing research and offered adult education programs. This spring the construction of a new wing and the renovation of the old building have been completed. With a beautiful, bright hall, office and research spaces, and a welcoming foyer, we have doubled the size of our facilities. And already in February we were able to use the new spaces in our course for farmers and apprentices. The spacious new rooms allowed for hands-on learning for the 25 participants. Photos in this issue will give you an impression of the new interior and how old and new harmonize with each other.

Work on this project spanned several years. Now, at its completion, we take a deep breath to appreciate everything and to express our gratitude to everyone who helped to make it possible. On May 25 and 26 we will celebrate the opening of the new wing with the community and friends of The Nature Institute.

Much has been going on at the Institute besides construction, and this issue of In Context lets you participate in three major strands of our work: Our effort to take up and illuminate new developments in science; the articulation of a truly holistic view of the world, here in the words of Henri Bortoft, who recently passed away and whose writings have stimulated so many people; and the engagement with the concrete phenomena of the world in a way that allows something of their essential nature to come to expression. We hope you enjoy this issue!

Craig Holdrege Steve Talbott



# The Nature Institute




*In Context*

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# Plasticity, Stability, and Whole-Organism Inheritance

*Stephen L. Talbott*

*The following are excerpts from "Genes and the Central Fallacy of Evolutionary Theory," the latest article to be posted on the portion of our website entitled "What Do Organisms Mean? Toward a Biology Worthy of Life." The article looks at the ways evolutionary theory has been founded upon the gene as the fundamental element of inheritance — and how the collapse of the classical, gene-centered understanding of the organism leaves the theory without any adequate grounding. The main argument of the article, only lightly touched on here, is that inheritance is always whole-organism inheritance, and that the organism as an active agent must become fundamental to our understanding of evolution. The full article is available at* http://natureinstitute.org/txt/st/org.

If I were to tell you that scientists have sequenced the genomes of two entirely distinct organisms — say, a flying creature such as a bird or bat, and a crawling one such as an earthworm or lizard — and had found the two genomes to be identical, you'd be sure I was joking. Surely such differently structured forms and behaviors could not possibly result from the same genetic instructions!

**Like a phoenix rising from its pyre**

Well, the fact is that *no* organisms result from genetic instructions (Talbott 2012). Moreover, there *are* flying and crawling creatures with the same genomic sequence. A monarch butterfly and its larva, for example. Nor is this an isolated case. A swimming, "water-breathing" tadpole and a leaping, air-breathing frog are creatures with the same DNA. Then there is the starfish: its bilaterally symmetric larva swims freely by means of cilia, after which it settles onto the ocean floor and metamorphoses into the familiar form of the adult. This adult, bearing the same DNA as the larva, exhibits an altogether different, radially symmetric (star-like) body plan.

Millions of species consist of such improbably distinct creatures, organized in completely different ways at different stages of their life, yet carrying around the same genetic inheritance. Isn't this a truth inviting the most profound meditation by every biologist? The picture is so dramatic that it deserves an extended sketch. I draw from a description of the goliath beetle offered by British physician and evolutionary scientist, Frank Ryan:

> Rather than a den of repose, we see now that the enclosed chamber of the goliath's pupa really is a crucible tantamount to the mythic pyre of the phoenix, where the organic being is broken down into its primordial elements before being created anew. The immolation is not through flame but a voracious chemical digestion, yet the end result is much the same, with the emergence of the new being, equipped with complex wings, multifaceted compound eyes, and the many other changes necessary for its very different lifestyle and purpose.
>
> The emerging adult needs an elaborate musculature to drive the wings. These muscles must be created anew since they are unlike any seen in the larva, and they demand a new respiratory system — in effect new lungs — to oxygenate them, with new breathing tubes, or tracheae, to feed their massive oxygen needs. The same high energy needs are supplied by changes in the structure of the heart, with a new nervous supply to drive the adult circulation and a new blood to make that circulation work. We only have to consider the dramatic difference between a feeding grub or caterpillar and a flying butterfly or a beetle to grasp that the old mouth is rendered useless and must be replaced with new mouthparts, new salivary glands, new gut, new rectum. New legs must replace the creepy-crawly locomotion of the grub or caterpillar, and all must be clothed in a complex new skin, which in turn will manufacture the tough new external skeleton of the adult. Nowhere is the challenge of the new more demanding than in the nervous system — where a new brain is born. And no change is more practical to the new life-form than the newly constructed genitals essential for the most important new role of the adult form — the sexual reproduction of a new generation. The overwhelming destruction and reconstruction extends to the very cells that make up the individual tissues, where the larval tissues and organs

> are broken up and dissolved into an autodigested mush . . . To all intents and purposes, life has returned to the embryonic state with the constituent cells in an undifferentiated form. (Ryan 2011, pp. 104-5)

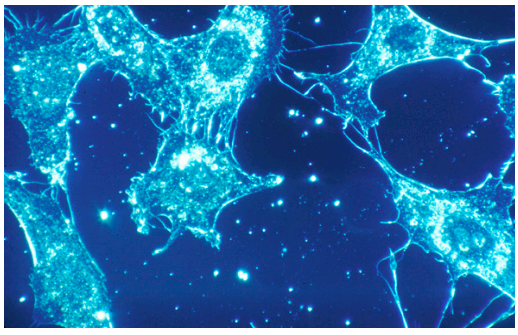
None of this is to say that DNA counts for nothing. It is no doubt as crucial in its special role as many other elements of the cell are in their roles. The larger picture may look something like this (from the DNA vantage point, at least; there are other worthy perspectives): the organism and its cells actively *play off* the genomic sequence within a huge space of creative possibility. Or, I should say (since the sequence as such is a denuded abstraction): the organism both modifies and plays off the dynamically sculpted chromosomes, thereby converting the sequence into an active, meaningful, three-dimensional structure (Talbott 2010a).

### The power of differentiation

But we don't need the mystery of metamorphosis to make the point at hand. As adults we humans embody ourselves in over ten trillion cells, commonly said to exemplify at least 250 major types. Moreover,

> different parts of the body have different subtypes of the major categories of cell type . . . [Also,] many transient cell types exist in embryonic development. ... When all these cell types are enumerated, there may be thousands or tens of thousands of kinds representing different stable expression states of the genome, called forth at different times and places in development. (Kirschner and Gerhart 2005, pp. 179-81)

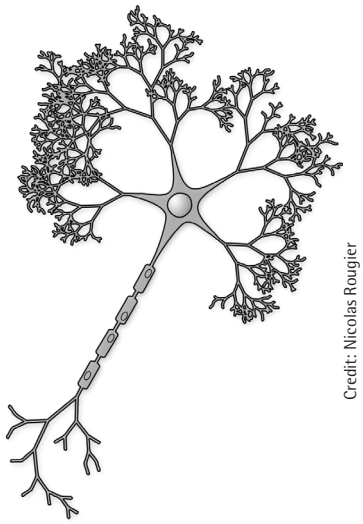
Actually, the emerging story today is even more extreme. Every cell is, to one degree or another, its own cell type. "A growing number of studies investigating cellular processes on the level of single cells revealed large heterogeneity even among genetically identical cells of the same cell type" (Loewer and Lahav 2011). For example, "identical" genomes in "identical" cells can assume altogether different three-dimensional configurations in their respective nuclei, with potentially dramatic implications for divergent gene expression (Krijger and de Laat 2013). That is, every cell is in one way or another "doing its own thing." Strikingly, however, the cell does its own thing only while heeding the "voice" of the surrounding context. It is disciplined by the needs of its immediate cellular neighborhood as well as those of the entire developing organism in its larger environment.



Credit:Cecil Fox, NCI

Connective tissue cells

The vast majority of cells in the body at all stages of development have (more or less exactly) the same DNA sequence. Yet the path from the singular zygote through the many stages of cell differentiation to a particular mature cell type is a path that, for every such type, takes a novel course. Each path of differentiation represents a distinct cellular "evolution", or active unfolding of potential.



Credit: Nicolas Rougier

Schematic drawing of a neuron

There are, for example, cells (neurons) that send out extensions of themselves up to a meter or more in length while being efficient at passing electrical pulses through the body. There are contractile cells that give us our muscle power. There are the crystalline-transparent fiber cells of the lens of the eye; their special proteins must last a lifetime because the nucleus and many other cellular organelles (prerequisites for protein production) are discarded when the fibers reach maturity. There are cells that become hard as bone; as easily replaceable as skin; as permeable as the endothelial cells lining capillaries; and as delicately sensitive as the various hair cells extending into the fluids of the inner ear, where they play a role in our hearing, balance, and spatial orientation.

So the same DNA sequence sits contentedly within the unique phenotypes of hundreds or thousands of mature cell types. Some of these are as visibly and functionally different, in their own way, as the phenotypes of any two organisms known to the evolutionary biologist. And in order to reach these mature phenotypes, this DNA must have yielded itself to the finely choreographed yet flexible and adaptive sequence of transformations along each cellular path of differentiation — transformations that are "remembered"

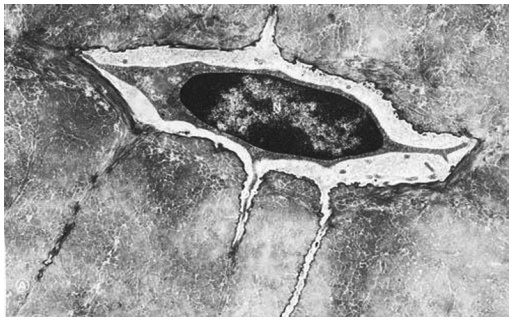
(inherited) from one cell generation to the next, yet take their place within a smooth trajectory of change.

## The whole cell: stable, yet capable of elaborate change

Who, in light of all this, will dare to claim: the numerous divergent pathways from the zygote to the various cell types of the body are explained by the one thing in the cells that remains more or less the same, namely, the bare DNA sequence, unstructured by the organism's developmental processes?

Moreover, once the "end point" of differentiation of a particular cell lineage is reached, the recognizable character of that cell type can be maintained indefinitely throughout the life of the organism and through all subsequent cell divisions. Or, in some cases, it can be changed further at need. Or, as with neurons and lens fibers, a cell can remain itself without further division over the several decades of a human life.

The power of the cell to remain itself in any one of many radically different configurations signifying radically different activities and conditions, has no particular temporal limit. *Both this stable character and the power of differentiation during development are guaranteed only by the qualities of the cell as a whole in its organismal context,* rather *than by a fixed sequence of nucleic acids.*

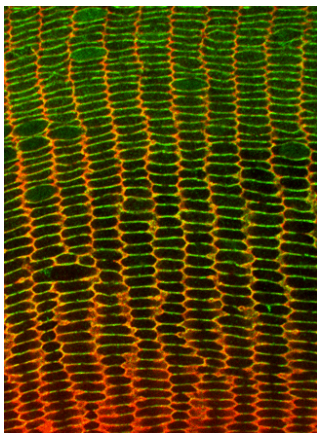


An osteocyte, the most common type of cell in bone

All these truths of development have yet to be taken with due seriousness by students of evolution. The individual organism expresses itself with almost incomprehensible eloquence, insistent aim, and aesthetic sensibility as it passes through the integral stages of unified metamorphosis or transformation — transformation involving much more than DNA. Yet this organism is somehow supposed to be rendered mute and directionless when engaged in the intricate, creative processes through which it contributes dynamic potentials to its offspring and shapes a space for their lives.

. . . . . .

The error at the core of the Genetic Dogma of Evolutionary Theory is this: it posits DNA as a clearly definable and static *thing*, a single substance that can be analyzed out of an almost infinitely complex, functioning whole and treated in this disconnected state as if it held the decisive causal explanation for the canonical form and character of that whole.



Credit: Journal of Cell Biology

Mouse lens fiber cells

But the organism does not consist of things. It is an *active agent* (Moss 2011) whose activity must be understood as such — which is to say, must be grasped as meaningful, contextualized, adaptive intent. And it would be a strange hope if we expected to comprehend the nature of this activity and its evolutionary potentials without first looking at the activity itself in the one place where we find it concretely embodied — in organisms, in their development, and in their life together. Here, then, is the position I am defending:

> **Against the Genetic Dogma of Evolutionary Theory:** The organism is an activity rather than a thing. It is a living agent whose life as a whole is a pursuit of its own ends and meanings. Its significant bequest to future generations consists of an elaborately chosen projection of its own life — not some single "controlling" molecular element — into a nascent life that is never less than a complete organism. This organism, as a physical entity, is without a beginning in any absolute sense. Its life is a continuation and transformation of the directed development of its progenitors. The heritable substance is never anything less than an entire organism.

There is nothing in actual organisms to suggest anything remotely like the standard evolutionary narrative. There is no single heritable substance as opposed to living cells or zygotes, no exclusive explanatory burden carried by DNA, and no rigid barrier separating the individual organism's life history from its contribution to evolutionary change.

. . . . . .

## What is inherited?

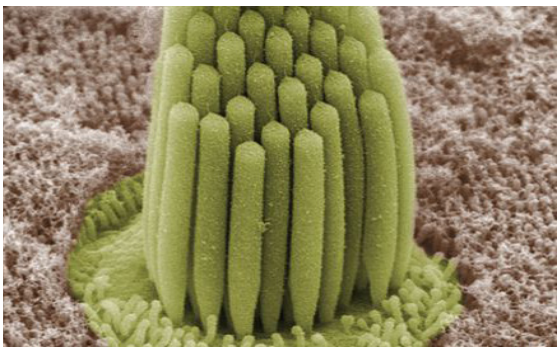
When Richard Dawkins wrote that "Bodies don't get passed down the generations; genes do" (2006, p. 79), he could not possibly have missed the truth by a wider margin. Genes, as biologically meaningful entities rather than as abstract and inherently meaningless sequences (assum-

ing, unreasonably, that they can be defined as "entities" at all) do not get passed unchanged down the generations — certainly not in the literal sense Dawkins intended. And bodies — complete organisms — are exactly what do pass from one generation to another, not indeed as precise replicas of their parents, but with the continuity of *active process* that matters for evolutionary change.

Dawkins' point, repeated in many places, is that "alterations in [the individual organism] are not passed on to subsequent generations" (1982). Taken at face value, the statement would be a monstrosity. Virtually everything in the gametes and the zygote is "custom-made" by the parents for their next-generation heir, all the way down to the detailed chromatin structure of the chromosomes. (Or, I should say, everything is custom-made in cooperation with the next-generation heir — for where, exactly, does the life of the parents end and that of the newborn begin?) Dawkins can say what he does only because he has no interest in organic change; he refuses to speak of anything other than alterations in what he imagines to be static, unlifelike structures that persist for many generations. He is interested in "replicators" that can be *acted on* by natural selection (Talbott forthcoming); he is not interested in the *agency* of an organism that is itself always responding to its environment and to its own internal imperatives — an organism "going somewhere", telling a story, even at the molecular level.

We know that the zygote is capable of all the transformations along the pathway from single, fertilized cell to mature organism, and we have seen that this maturation process is an activity of the entire cell and entire organism. Life scientists, from molecular biologists to naturalists, routinely describe the organism's life in narrative terms (Talbott 2011), and *it is the character of the narrative that must change in a coherent manner from generation to generation if evolution is to occur.* It must change in the only way an integral narrative context can change, through a continual mutual adjustment of directed activities — an adjustment that may secondarily lead to altered structures (Talbott 2010b). These structures are often where our study must begin. But they are coagulations of an ongoing activity — more like residues of that activity than causes of it, just as a spluttering cauldron of magma is continually clotting here and there into partially hardened rock.

In slightly different words: what we need is not so much the stable transmission of thing-like replicators as the *stable intention of the organism itself.* Here "stable intention" is not too mysterious for biologists to face. It refers to something like the directedness and adaptive stability we already witness in individual development. And this individual development is not separable from the processes at work in evolution. After all, the individual's physical body is potentially "immortal", inasmuch as it passes alternately through an expansionary phase of development and then a contraction into the still living germ cell, followed by another expansion. There is never anything but continuous life in this ongoing narrative. The living, directed capacities we see in the passage from adult to germ cell and zygote are not different from the capacities we see in the passage from zygote to mature adult.



Mouse stereocilia — minuscule hair-like protrusions on the surface of sensory cells (hair cells) found deep within cochlear and labyrinth structures of the inner ear

The one-celled zygote, as a whole organism, is the bearer of this narrative, and therefore is the heritable substance. It does not develop into an organism under the autocratic control of just one of the contents it effectively coordinates; it already is the whole organism. This is why it can so deftly execute the subsequent spatial re-organizations, cell divisions, normal developmental processes, and adaptations to unforeseeable disturbances, all in order to produce the orderly stages of its own existence. The passage of this directive capacity down through the generations is the essence of inheritance, and any evolutionary process must derive in the first instance from changes in the overall character of the activity.

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# Light in the Dark

*Henrike Holdrege*

I vividly remember a visit to an art museum in the early 1980s in West Berlin, Germany. In one of the great halls a room had been built, with walls, ceiling, and well-designed entrance and exit. When I entered that room I found myself in darkness. Other people were also there. I could hear them, but I hardly saw them. Suddenly a person moving about was lit up, visible in all her colors. Moving a little further, she disappeared in the dark again. It impressed me that, when nobody occupied that magic space, we could not know it was there.

This observation has stayed with me ever since. It taught me to pay attention, in nature and in my home, to related phenomena. I often marveled at how the museum installation was done. Now, after years of studying phenomenological optics, I know how the design of such a room must look. In the summer of 2012, during a course at The Nature Institute dealing with light and color, I managed to arrange a successful demonstration akin to that in the museum in Berlin thirty years ago.

During the first morning of the weeklong course we worked in a carefully prepared classroom. Each of its three windows and three glass doors had been completely blacked out. At the beginning of the second day, I asked the course participants to come again into that dark room. They took a seat. The chairs were arranged so that everyone faced a table at one end of the room. On that table they glimpsed some black and dark-blue things. But we immediately closed the door and switched off the lights, enveloping us all in black darkness. Nothing could be seen. Nobody spoke. Suddenly a crystal glowed. Seemingly out of nowhere it hovered in the air and shone in dazzling brightness. It disappeared and then appeared again. Everyone saw it and was amazed. To some it seemed they could reach out and touch it. Others saw it a few yards away, and still others saw it so far away that it would have to have been in the yard outside the classroom.

All the materials I used for the demonstration are easy to find. However, I carefully chose a certain crystal. It was a relatively large Iceland spar with regular faces. It was colorless, translucent, but with enough irregularities to be altogether bright when illumined. The light penetrated it. In its clarity of form and its transparency such a crystal is the best object I can think of to make the light manifest in such a demonstration. Crystal and light have a kinship. When we saw it shining in the otherwise completely dark room it made a deep impression on all of us.

To prepare the demonstration I placed two cardboard tubes on a table that was covered with black poster boards. One tube was short and narrow, the other long and wide. Inside and outside, the small tube was covered with black fabric and its one end was tightly closed. Its other end was open and pointed to the opening of the second tube. That tube, covered by dark fabric, had its far end closed by layers of heavy black cloth. Between the two tubes was a space. I placed a flashlight deep inside the small tube and turned it on before everyone entered the room. Its light shone into the large tube.

When the lights in the room were switched off, I stood near the table, and after we had been a short while in the dark, I quietly lowered the crystal into the space between the two tubes. It was fastened on three threads so that it would not turn or swing. My hand holding the threads could not be seen and all my doings went unnoticed. What people saw and experienced was the magic of a crystal shining in the dark. If you have never seen such a demonstration, you may find it difficult to imagine the dramatic effect: suddenly a beautiful, multifaceted object appears as if from nowhere.

The crystal as it appeared lacked all visual context: there was no foreground or background. There was nothing to compare it with. Since none of the course participants had seen the crystal before, they could not know its size. Although everyone saw it distinctly, some judged it to be small and near by, others to be larger and further away, and still others to be a fairly large object far off. The measurable size and distance of the crystal remained "in the dark."

When the participants entered the dark room, they believed it to be void of light, as it had been on the previous day. To their surprise they found that it was not so. But only when the crystal was placed in the beam of the flashlight did the light become manifest. While we see the illumined things in their colors and shades, we do not see the light itself. It is not a thing to be seen. It is the potential for things to become visible in their spatial relationships.

The air in the room between the two tubes did not suffice to make the light-filled space manifest, but air-borne dust particles or smoke would have done so. We would have seen a bright space with clear boundaries between the two tubes.

Likewise, on a hazy day among trees we see sunbeams as the sun shines through the canopy, while on a clear day we see only the sunny spots on the forest floor. As Martin Wagenschein writes in his short, beautiful text on "Sunbeams": "So that is how the light is … By itself you cannot see it, only through the objects. And the objects themselves are invisible unless you see them in light."

When you stand under the stars at night and look up at the starlit dark sky, you look into light-filled space. Every celestial body that is not self-luminous, like our moon and the earth itself, creates a shadow space behind itself ("behind" in relation to the sun). When, for instance, the earth moves into the moon's shadow space, there is a solar eclipse. But except for those shadow spaces, cosmic space is light-filled, just like the space between our two hollow tubes. Sunlight in the night sky—like our flashlight—gives visibility to moon and planets and to all kinds of man-made objects.

We can therefore speak of two types of darkness. The first type of darkness is a space void of light. I call it cavern-darkness. Opaque matter surrounds a hollow space and shuts out all light. Here is no potential for something to become visible, no possibility for brightness or for colors to appear. Here will be lasting darkness unless a light source is brought in. The other type of darkness I call cosmic darkness. This darkness is dark not because the space is void of light, but because there is no matter to be illumined.

So just as there are two types of darkness, matter also has a double aspect: it is needed to shut out light and create a cavern-like, pitch-dark space, but it is also needed for the creation of a bright and colorful world.

The absence of light in the cavern and the absence of matter in the light-filled space both allow for darkness. The difference between the two is that only in the light-filled space is there—with the help of matter—the potential for brightness and color. Out of the interplay of light and matter our visual world arises.

# The Form of Wholeness

## Henri Bortoft on Multiplicity and Unity

*Henri Bortoft, a preeminent student of Goethean science and wholeness in nature, died at his home in Norfolk, U.K., on December 29, 2012. He was seventy-four years old. (See also accompanying sidebar.) In May, 1999, Henri participated along with members of The Nature Institute and a number of others in a symposium sponsored by the Center for the Study of the Spiritual Foundations of Education at Teachers College, Columbia University. We present below a few selected passages from Henri's presentation, "Goethean Science and the Wholeness of Nature." Henri was known for his wide-ranging observations and his tracing of historical connections—all of which made for wonderfully illuminating excursions. But it means that the following brief collection of fragments can hardly give an adequate impression of his presentation. (Bracketed text in italics is the editor's. There has been abridgment and slight paraphrasing of the passages presented here.)*

Goethe [sought a method that, in his words] "did not treat of nature as divided and in pieces, but presented her as working and alive, striving out of the whole into the parts." The first thing we notice here is the reversal of perception: not from the part to the whole, but from the whole into the parts. Goethe was someone who could see the wholeness in nature directly, and, furthermore, had specific practices that could lead to the ability to do so.

. . . .

[There is a movement of thinking that] begins with the finished products, whether these be organs or organisms. It starts from a set of entities taken as given, and from there it can only go further "downstream," which it does by abstracting from them what is "common." We come in this way to "unity in multiplicity" by the elimination of difference. [*An example is found in the way apple trees, roses, and strawberries are classified as members of the same larger family by virtue of certain traits they have in common: number of flower petals, number of stamens and pistils, and so on.*] This is therefore an abstract unity. It is also a reductive unity because it reduces multiplicity to unity, diversity to identity, by finding the respect in which the different "entities" (organs, organisms) don't differ at all but are the very same. This is the static unity of self-sameness.

It is clear from the movement of thinking by which it is formed that "unity in multiplicity" is the unity of the dead end. [It is] a consequence of beginning from things in their finished state (the given) and then going "downstream" into abstraction, instead of reversing the movement of thinking so as to catch things in their coming-into-being and thereby ending, instead of beginning, with "the given."

. . . .

Rudolf Steiner, in *Goethe's World View,* remarks that Goethe "seeks to bring the diversity back into the unity from which it originally went forth." Goethe's thinking [as shown in the following remarks] goes back "upstream" and "flows" down with the coming-into-being of the phenomenon:

> "It had occurred to me that in the organ of the plant which we ordinarily designate as the leaf, the true *Proteus* is hidden, who can conceal and reveal himself in all forms. Forward and backward the plant is only leaf."
>
> "[Nature] produces one part out of another and creates the most varied forms by the modification of one single organ."
>
> "It is a growing aware of the Form with which again and again nature plays, and in playing, brings forth manifold life."

This is the dynamical thinking of the participant mode of consciousness, instead of the static thinking of the onlooker consciousness. This way of seeing turns the one and the many inside-out. Instead of many different ones that are the same, we now see one which is becoming itself in many different ways. What we have here is self-difference instead of self-sameness; each is the very same one, but differently, instead of each of the different ones being the same. We now have difference within unity, instead of a unity that excludes difference. Furthermore, it is concrete instead of abstract. So instead of "unity in multiplicity" we have "multiplicity in unity," which is the unity of the living source.

We must be careful here not to think of "multiplicity in unity" as if it implied that unity is divided, in which case it would not be unity. If we divide a photograph of a subject, then we have two halves of the photograph with half the subject on each. But if we divide a hologram of the same subject, astonishingly we have two holograms with the whole subject on each. We have divided the hologram materially, but optically it is whole. So how many holograms are there now? Clearly there are two, but since each one is the original whole, there is in some sense one only.

We easily miss what is happening here because of our ingrained habit of thinking in terms of the logic of solid bodies. The arithmetic of wholeness is very different from the arithmetic of bodies. This is where we need to think intensively instead of extensively.

Vegetative reproduction by taking cuttings is another illustration that can help us to see the intensive "multiplicity in unity." Organically they belong together because each is the very same plant, [although] we see "extensively many" plants that we can count bodily. Here again we have the indivisibility of the whole: it can be divided and yet remains whole.

. . . .

"Multiplicity in unity" cannot be mapped onto the bodily world, and so we cannot form any sense-based mental picture of it. But we can see it, in the phenomenological sense, though it may take practice to be able to do so. We are by now familiar with the need to give up the habit of forming mental pictures based on the bodily world we encounter through the senses. Developments in mathematics in the last [nineteenth] century and physics in this [twentieth] century have brought this home to us—and no longer should we see this as a limitation on knowledge, but as the liberation from a restriction which we were not aware of as such.

[Regarding the metamorphosis of plants:] What Goethe means by "metamorphosis" is this dynamical unity of self-difference, the intensive movement that produces the intensive dimension of One that is "multiplicity in unity." This is how the following description of the inner activity of imagination should be understood:

> When I closed my eyes and lowered my head, I could imagine a flower in the center of my visual sense. Its original form never stayed for a moment; it unfolded, and from within it new flowers continuously developed with colored petals and green leaves.

The experience Goethe describes is intrinsically dynamical. It is not one plant followed by another plant, and another one, and so on to result in an extensive sequence of different plants. This is One plant being itself differently. We have to "give up thinking in terms of beings that do, and think instead in terms of doings that be" (J. G. Bennett).

What is being experienced is literally the self-manifesting of the phenomenon itself and not just a mental representation of it. This seems strange to us moderns especially when we conveniently forget about the intractable difficulties with the representational theory of knowledge. But [Hans-Georg] Gadamer reminds us that "this involvement of knowledge in being is the presupposition of all classical and medieval thought," which understood "knowledge as an element of being itself and not primarily as an attitude of the subject." It is within the context of this tradition that the following remarks by Goethe are to be understood:

> "Through the contemplating of an ever creating nature, we should make ourselves worthy of conscious participation in her production."
>
> "There is a delicate empiricism which makes itself utterly identical with the object, thereby becoming true theory. But this enhancement of our mental powers belongs to a highly evolved age."

Returning to the single plant, the organs up the stem can be perceived in the mode of One organ metamorphosing into different modes of itself, whereupon the visible sequence of organs can then be seen as a whole movement of which these organs are simply "snapshots." There is a reversal of perception here: the movement is not made out of the sequence of organs, but the organs are "made out of" the movement.

There is a single form, but it is not what the particular organs have in common. It is the unity that is the whole movement—the single form is dynamical and not static. A common form could not generate the movement [because it contains only the abstracted common elements and not the potential for diversity], whereas here it is the movement that generates particular forms (organs). [The late philosopher Ron] Brady concludes: "Thus the movement is not itself a product of the forms from which it is detected, but rather the unity of those forms, from which unity any form belonging to the series can be generated."

Furthermore, we can now see why any form in the series (whether of leaves only, or all the organs up the stem) can be taken as representing all the others in the series. Each part is a manifestation of the whole ("striving out of the whole into the parts"), so each member of the series is the One organ metamorphosing into different modes of itself. Thus any organ of the series can function as a concrete symbol for all the others, and the entire series.[1]

This is what Goethe meant when he said, "All is leaf." Because of the habit of thinking in the mode of "unity in multiplicity," this statement has usually been interpreted as implying somehow that there is a common plan, the term "leaf" here referring to a kind of generalized image formed by abstraction. But Goethe is thinking of the organs not as a set of finished products to be compared, but as a "coming-into-being" series produced by the One organ metamorphosing into different modes of itself, so that any one mode of this organ can function as a concrete symbol representing the entire series that is thus generated.

. . . .

It is especially characteristic of what is living that, in Ron Brady's succinct phrase, "it is becoming other in order to remain itself." (It is interesting that Darwin also seems to have reached this point, especially in his work on barnacles, but then to have missed its significance because instead of seeing the phenomenon he wanted to explain it.)

All people can practice this way of seeing for themselves. It is, for example, possible to see a particular family of plants in its organic mode. It is an enlivening experience to observe the different members of a family such as Rosaceae (including rose, blackberry, strawberry, and apple) and begin to see them as One plant in the form of "multiplicity in unity." How different the experience of this is from that of looking for what these different plants have in common.

[In "What Does It Mean To Be a Sloth?"[2]] Craig Holdrege shows us how the characteristic way of being of the sloth reveals itself through the different manifestations of the sloth, so that "Every detail can begin to speak 'sloth.'" Phenomenology does not try to explain but to understand. It tries to catch sight of the intrinsic intelligibility of the phenomenon ("its own reason to be"—Goethe), instead of leaving the phenomenon in order to explain it by means of something outside itself. When we begin to see the whole animal, then every detail of the animal is seen to be consistent with the characteristic way of being which is that animal.

It is a consequence of the way that modern biology has developed that the organism as such has disappeared from view and has been replaced by genes as the fundamental units of life—what Professor Espinasse called "little causal thingummies" (quoted in Marjorie Grene, *The Knower and the Known,* p. 235). The importance of turning now, at this very time, to an organocentric biology, which is the biology of the whole organism, cannot possibly be overestimated. Even without considering the genetic factor, the tendency is to see organisms in a mechanical fashion, that is, as an aggregate instead of an organism. But when the organism is seen as no more than an aggregate of bits, then it seems quite natural, once the biotechnology becomes available, to simply change any bit we choose independently of the others. As everybody knows, this is the situation we have now reached with genetic engineering.

NOTES

1. For a more detailed examination of the sort of unity and wholeness found in the sequence of leaves on a plant, see "Can We Learn to Think Like a Plant?" available at http://natureinstitute.org/txt/st/mqual/ch09.html

2. You will find Craig's essay, "What Does It Mean to Be a Sloth," at http://natureinstitute.org/nature/sloth.htm

It was in the early 1990s that I first encountered the work of Henri Bortoft. It made a deep impression on me. Henri was able to articulate the nature of wholeness and dynamic thinking in a way that I had never encountered before. In one way he was saying what I already knew, but he was saying it in a way that brought me to greater clarity and depth of understanding. Again and again I would inwardly rejoice in his formulations, for example:

> The whole comes to presence within its parts, and we cannot encounter the whole in the same way that we encounter the parts. We should not think of the whole as if it were a thing.

Some years later I met Henri and experienced him in lectures, had conversations with him, and also sat in on a week-long course he gave at Schumacher College. What impressed me most was that Henri did not just talk about dynamic thinking, he lived it and disclosed it in his teaching. He was always present, thinking the thoughts at the moment, constantly working to find an adequate expression for the fluid nature of life as we participate in it. He rarely fell into the dualism that confounds the modern human mind. He was, to use Henri's own expression, always swimming upstream to catch the world in its becoming.

Because we all have an ability to perceive the presence (and absence!) of thinking in another human being, when you entered into Henri's flow of thought, you were truly in it and "got" it. Afterwards, in reflection, it was not necessarily the case that you could return to that life; you knew you had been there but it would take effort to get back into the stream of becoming. Here Henri's writings helped. In a sense, he said the same thing over and over again in slightly different ways and from different points of view. But when you took the time to enter the particular flow, you began to see and think dynamically. In essence, he showed that it's all about practice. How many times have I found myself and others pondering, "Now was it 'unity in multiplicity' or 'multiplicity in unity'?" You had to get back into the thought process to know, and the knowing was real as long as it was being created and lived.

Henri always emphasized that the world evolves through the fact that we participate in it. I hope that Henri's writings and his living view of the world continue to evolve and to become a stronger presence in the world through the efforts of the many minds who engage them.

Craig Holdrege

# Farmers at The Nature Institute

In February twenty-five farmers, farm apprentices, and gardeners gathered at The Nature Institute for a weeklong course. This course is offered as an intensive for participants in the North American Biodynamic Apprenticeship Training and is open to others as well. This was the first course in the new wing of our building, and it was wonderful to have adequate space for all the different activities (see photos).

A central aim of the course is to help participants learn to observe and think about nature and their work in qualitative and relational ways. There were three areas of exploration. We studied the four elements—solid, fluid, air (gas) and warmth—through a variety of practical activities. As one apprentice wrote in her evaluation, "The exercises relating to the elements (water movement, air movement, etc.) were really stimulating and inspire a deeper kind of looking." Two sessions each day were dedicated to the study of animals. We considered the contrasting and mutually enhancing ways of being of plants and animals. We observed farm animals and considered in some depth the cow. This work culminated in a consideration of domestication and the relation between animals and human beings in farming and evolution. Each day concluded with a session on astronomy—helping participants understand the basic relations between earth, sun, planets, and, stars.

Here are some comments from different participants about the course as a whole:

"The approach/perspective of the teaching was a major contribution to my enjoyment of the coursework. Coming from a standard education background, I found the open-ended and inquisitive nature of the course to be liberating." (Apprentice)

"I have never before experienced such a patient and beautifully interwoven presentation of ideas, concepts, questions, observations…. I loved both listening and engaging with the material through 'experiment', observation and discussion – I thought that the active and more passive (i.e. listening) exercises in learning were very well balanced. I am used to learning in a very rigid, structured manner; I am accustomed to overflow of facts. This course seems to be aimed at deeper aspects of learning: thinking, attitude, and perspective. Facts slide from the surface of thought, whereas developing thinking and perspective is something internalized and lasting. I especially loved the interwoven nature of the course: for example, speaking of liquid as a state of matter and then discussing the fluidity of thought and then transitioning into the fluid nature of a cow. Everything was so artfully connected in its patient presentation!" (Apprentice)

"The content was all very interesting, and particularly the way it was presented. I appreciated how over the course of the week we were carried through a process, whereby every subject eventually came together to build an overall picture. This will allow for the perspectives and practices in observation to carry over into practice when we no longer have this wonderful context to work within." (Apprentice)

"I found the course content to be very grounding and yet meaningful from a personal subjective point of view. Learned a lot about the Earth, animals and the stars, and got a sense of how it all interconnects. It was helpful in using my observational skills to an extent beyond the norm and developing appreciation for nuances in nature and objects. Though my interest is primarily gardening and horticulture, I benefited from learning all different dimensions of farm life and the wonders of the natural world." (Gardener)

# In Conversation

An essential element of our work at The Nature Institute doesn't make itself apparent in lectures or publications. This is the area of dialogue and conversation with colleagues and supporters. Some of this happens through email, but person-to-person interactions are especially important to form new connections and to strengthen existing ones. Some of these interactions occur during breaks at workshops or courses. We also make concerted efforts to meet with people to address specific topics and concerns. All this helps create a community of striving people who inspire one another. It may not lead to all the collaborations we could envision, and it is a fact that most everyone today finds him- or herself with "too much to do." But knowing we are contributing to something larger—something carried in a variety of ways by individuals and institutions around the globe—invigorates our efforts.

It's not possible to describe such conversations, but I'd like to mention a few that I've had in the past months. While in California I met with Beth Weisburn of the Center for Contextual Studies to discuss science education and the training of science teachers.

I also took long walks and conversed with John Gouldthorpe in Point Reyes Station about John's plans for a "Point Reyes Center for Radical Thinking" (working title). We also discussed participatory knowing, the nature of models, and much more. For a forthcoming audio project, John interviewed me about the Goethean approach to science. While in Minneapolis, Minnesota, I spoke with Albert Lindermann and Bill Manning about the challenging task of grasping and writing about a spiritual perspective on evolution, and in what ways it would be possible to present—in a manner appropriate for our times—Rudolf Steiner's deep and far-reaching view of the spiritual basis of all evolution that he portrayed one hundred years ago.

On my trip to Europe in March, I spent a few days at the Science Research Laboratory at the Goetheanum, Dornach, Switzerland. This is where, thirty-four years ago, I studied the Goethean approach to science for a year and carried out a project on a phenomenological approach to heredity. On this current trip I worked with my friend and colleague, geneticist Johannes Wirz, and was able to visit my former teachers and mentors, Jochen Bockemühl and Georg Maier. CH

# Building Expansion Completed!

As we hope you can discern from the photos, the new wing is beautiful and provides a fine setting for our education work. We are also pleased that the wing was built in an energy-efficient way. Here are some of its "green" features:

- The lower level is constructed out of 14-inch insulated blocks that consist of concrete-bonded, recycled waste wood fibers.
- Siding is rough-cut white pine harvested in the northeast.
- Deck boards are rough-cut white oak harvested in the northeast.
- The upper level has 9-inch thick walls, and the framing consists of two parallel rows of 2 x 4-inch studs, so that there is no thermal bridge between the outside and inside. Insulation consists of blown-in, recycled cellulose in the walls and loose cellulose in the attic.
- All trim, window sills, baseboards, and stair treads are made of wood that we salvaged from the December 2008 ice storm; we had trunks from oak, hickory, maple, and pine trees that were locally milled, dried, and planed.
- We installed geothermal heating systems in both the new and old wing. These are very energy-efficient systems that utilize the constant ground warmth of 50 degrees Fahrenheit. Fluid circulates in closed loops through ground wells and warms (in the winter) or cools (in the summer). The heat is transferred and, in the winter, raised to a higher temperature through heat pumps; in the existing building air is warmed (forced-air heat) and in the new wing fluid is warmed that circulates through tubes in the floor (radiant floor heat).

We also renovated the outside of the old building. We added an inch of insulation all around and then sheathed it with the same white pine siding that is on the new wing. In this way 'old' and 'new' have a unified appearance.

# Here, There, and on the Printed Page

• *Mathematics Alive!* Ten middle and high school teachers braved a winter snow storm to arrive for a weekend workshop at The Nature Institute in early March on algebra and the golden mean. The workshop was led by Henrike Holdrege and Marisha Plotnik, and in light of the responses of participants, it looks like "Mathematics Alive" is going to become a yearly event. This was the third year we've offered it. One participant remarked, "I got lots of ideas of how to introduce algebra to the class in a deeper way. We've done a short 'Introduction to Algebra' block, but now I can really build on it in new ways—from many different angles, as you so expertly showed us." The workshop involved a variety of activities—presentations by Henrike and Marisha, movement exercises, games, problem solving in groups, and dialogue. In the words of another teacher, "the workshop this weekend was extremely helpful for teachers of all levels. The ideas presented to us are definitely going to be useful in helping students grasp mathematical concepts more thoroughly. It makes the math much less frightening for students, especially for those who struggle."

• *Giraffe at the library.* In December Craig gave a talk with slides at the local Philmont Public Library on "There's More to a Giraffe than its Long Neck." The talk was sponsored by the local arts and education organization, Free Columbia.

• *Explanatory genes?* January finally saw the publication by Harvard University Press of *Genetic Explanations: Sense and Nonsense,* containing Steve's chapter, "The Myth of the Machine-Organism: From Genetic Mechanisms to Living Beings." The chapter looks at how the concept of the controlling and explanatory gene has been giving way to a growing awareness of the coordinated activities—the "intentions"—of the cell and organism as a whole. It then addresses the problem of meaning and intention in the organism, asking whether such terms force one into a mystical mode of thinking or (as the chapter argues) are fully compatible—and indeed required—by a scientific approach. Steve subsequently expanded this chapter into the first three major articles found at The Nature Institute's "What Do Organisms Mean?" website (see below). Those articles are: "Getting Over the Code Delusion,"

These pictures were taken in February, right after a lovely snow storm and right before a course for farmers and apprentices, which was the first event to take place in our expanded facilities.

The photos of the interior show the large classroom (800 square feet) and the foyer that connects the new wing to the original building.

"The Unbearable Wholeness of Beings," and "From Physical Causes to Organisms of Meaning."

• *Living thinking.* At the annual conference of Western Waldorf Teachers in February at Rudolf Steiner College in Fair Oaks, California, Craig conducted a six-session workshop concerned with "Cultivating Living Thinking in the Sciences." He also delivered a keynote talk, "The Curriculum: Directive or Living Process?"

• *Evolution.* Craig gave a series of three public talks in Minneapolis, MN, on evolution, sponsored by the Two Rivers Folk School.

• *Genes and evolution.* At the very end of February Steve published on The Nature Institute's "What Do Organisms Mean?" website his latest article, "Genes and the Central Fallacy of Evolutionary Theory." At considerable length—and dealing especially with the nature of whole-organism heredity—he shows how the genetic foundations of existing evolutionary theory have crumbled, leaving a hollow logical structure in place of a real theory. The article is accompanied by a summary, a set of brief excerpts, and five shorter, supportive pieces. You'll find them all at the "What Do Organisms Mean?" website: http://natureinstitute.org/txt/st/org.

• *Light and darkness.* Henrike traveled to Florida in March and was the main presenter at the 9th annual Florida Anthroposophy/Waldorf Education Conference. The theme of the weekend conference was "The World of Light, Color, and Darkness: Contemplative Goethean Practice." She held an introductory talk, "Inner and Outer Light," that was followed by a three-part workshop on the conference theme. The conference was held at a retreat center near Tampa.

• *Biology for the living.* In March at the International Refresher Week for high school teachers at the Institute for Waldorf Education in Kassel, Germany, Craig gave a 10-session course on "A Biology Worthy of Life" that focused on how teachers can work with students in developing dynamic and relational ways of understanding biological phenomena such as heredity. He also gave a keynote talk to all conference participants—over 200 teachers from more than 20 different countries—on "Living Thinking."

• *Seeing afresh.* In April Henrike and Craig were invited to hold a half-day workshop on "Seeing With Fresh Eyes" for staff of the Center for Discovery in Harris, New York. The Center "offers individuals with a range of disabilities and medical frailties—and their families—innovative educational, clinical, residential, and social and creative arts experiences designed to enrich their lives through personal accomplishment."

• *Language of the embryo.* The Spring, 2013 issue of the *Journal of Pre- and Peri-natal Psychology and Health* contains Steve's article, "The Eloquent Embryo." The article was stimulated by a 2007 workshop conducted by Dutch embryologist, Jaap van der Wal at The Nature Institute, and was Steve's attempt to report on a body of research relating to the expressive language of the developing embryo. That language has a lot to say about the age-old question, "Where do we come from?"

The article is also available on our website: http://natureinstitute.org/txt/st/mqual/embryo.htm

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## People Make a Building Possible — Our Thanks

As we stand in the warm afternoon glow of the main hall of the new building wing, our thoughts range outward to the large circle of all those who contributed time, materials, and money to make the building possible. We hope you will find occasion during the coming years to join us in this building, and that in the meantime you know how deeply grateful we are for the generosity of spirit that is the life-spring of every new venture.

Craig Holdrege, Director

# Rooted in the World

Craig Holdrege

*Do you seek the highest, the greatest?*
*The plant can be your teacher:*
*what it is without volition*
*you can be willfully—that's it!*

Friedrich Schiller

*This is an excerpt from a chapter in my forthcoming book,* Thinking Like a Plant. *The book is written as a practical guide for learning to think the way nature lives. It will be published by Lindisfarne Books and will be available in summer 2013. While this excerpt can stand by itself, I hope it piques your interest to read the whole book.*

When an acorn falls onto the ground in the autumn it comes to rest in a particular location. It may be eaten soon thereafter by a mouse. It may rot in the autumn rains. A squirrel might pick it up and carry it in its cheek to another part of the woods, dig a hole, and place it there. Even in this case the acorn's fate is still open—it depends on whether the squirrel digs it out and feeds on it in the winter, it decomposes, or it germinates and grows into an oak sapling.

Before germination, the life of the plant is encapsulated in the protective sheath of the seed (and in many cases, of the fruit as well). This stage is life held back—full of possibilities yet to be realized—until the seed gives up its encapsulated state and opens itself to the environment. The opening often has preconditions: there are seeds that need a period of dormancy before they will germinate; others need to germinate soon after separation from the mother plant, otherwise they die. Some seeds need to go through a period of cold before germination, while others even need to experience extreme heat (fire) to allow them to germinate. Whatever the specific and intriguing prerequisites may be for germination, the movement from the state of encapsulation to the actual unfolding and development of the seedling is a significant moment in the life of the plant. The plant's life can only unfold when it gives up being an object, when it grows out into and connects with the world in such a way that the world supports its further development. It cannot be a plant—which means to be a becoming being—unless it gives up its isolation and draws from the world.

Seeds are the most compact, solid, and, from an external perspective, the most self-enclosed, object-like stage in the life of the plant. Seeds are drier than other plant parts, and a key moment in the opening to the environment occurs when the seed casing allows water to penetrate into the seed, tissue swells, and the casing breaks open. The seed thereby forms a connection and continuity with the fluid environment. The water also allows its physiology to become active—what was solid as stored nutrients becomes fluid, and growth begins. Since water is the medium of active life processes, it is perhaps not so surprising that the generative (meristematic) tissues of the plant consist of 80 to 90 percent water; even wood consists of about 50 percent water. (On average, only around 2 percent of the live weight of a plant consists of what was taken as dissolved minerals from the soil.)

Regardless of the position in which the seed finds itself in or on the soil, when it germinates the seedling begins to orient itself in the environment: the root grows downward into the soil and the shoot grows in the opposite direction, away from the earth, and into the light and air. In growing straight downward, a primary root orients toward the center of the earth. We can imagine the taproots of all the plants on the planet as growing toward this center. So when the plant develops one pole in its root that grows into the earth and another pole in its shoot that grows away from earth, it is placing itself into a huge planetary context. But it is also and importantly relating to its immediate, concrete environment. Whether the seed germinates at all and how it develops depend on what it meets when growing out into the environment with its particular and ever-changing constellation of light, wind, moisture, animal life, soil consistency and chemistry, and so on. As plant ecologist Walter Larcher remarks, "the process of emergence and the seedling stage represent a particularly sensitive period" in the life of the plant (2003, p. 312).

The foremost activity in early development is rooting—the plant connects with and anchors itself in the soil. The root of the bur oak seedling grows rapidly into the soil (see Figure 1). Shoot growth follows. Root growth draws from the reserves of the past season that have been stored as nutrients in the seed. It is important, when trying to picture growing roots, to realize that roots grow near their tips, and they continue growing throughout the life of the plant. The primary downward growth of the primary root is initiated immediately behind a protective cap at the tip, and the same is the case for the lateral roots that develop over time. So in imagining the development of the rooting body we have to picture generative activity at the periphery, in all the root tips. Just behind the tips, roots develop fine root hairs that are the active interface with the environment. They increase the surface of the roots immensely and take in water and dissolved minerals. In this way the plant establishes intimate contact with its soil environment. Most plants not only open themselves to interaction with the soil directly, but also join together with fungi to form a symbiosis that extends the plant's life even farther into the soil environment. Through these mycorrhizal fungi, the roots' absorbing surface for water and minerals is increased significantly and in return the fungi receive organic nutrients from the plant.

The roots are not only active in growth and taking up moisture and minerals, they also secrete substances such as acids into the soil, an activity that chemically alters the soil and gives the plant access to minerals it would otherwise simply pass by.

In growing upward into the light and air, the shoot-pole of the plant opens itself in a different way to different qualities of the environment. In contrast to the dense medium into which a plant roots itself, the shoot grows upward into the more rarified environment of light and air. In so doing it forms leaves that spread out as surfaces into this environment. Through its leaves the plant bathes itself in the light and air. The leaves have tiny pores—usually on the underside—through which air enters and departs. The air circulates through air-filled spaces in the leaves and becomes part of the plant's "food." In the presence of light the stems and leaves become green, and in greening they can utilize the light of the sun for the plant's growth and development. Through light, carbon dioxide from the air, and water and a small amount of dissolved minerals from the soil, the plant builds up its own body.

We should take a moment to appreciate this remarkable capacity of the plant. The plant can make its own living substance on the basis of light, air, water, and small amounts of dissolved minerals. What a contrast to our animal way of life that demands we live from already existing plant or animal substance. How different it would be if, to have a meal, we could go out and expose ourselves to the sun for a number of hours while drinking lightly salted water! But that is not how we are organized; we are more enclosed from the immediate environment, while plants have "an open form through which the organism in all its manifestations of life is directly integrated into its environment" (Plessner, 1975, p. 219). By taking root in the earth, plants become in a way more dependent on their environment and more vulnerable than a roaming, self-mobile animal. But this dependency is the flip side of openness to the environment and the plant's ability to engage with that environment and to do what animals cannot, namely create, essentially out of air and water, living substance.

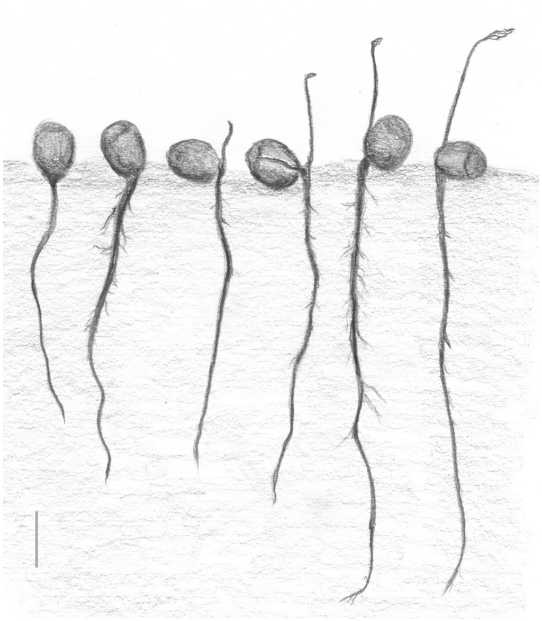

Figure 1. Bur oak (*Quercus macrocarpa*) seedlings, showing development following germination; scale bar = 1 inch (after Holch, 1931, p. 268).

Figure 2 shows three representative bur oak saplings that grew in three different environments within a quarter mile of one another in eastern Nebraska.

The soil was removed from the roots and the plants were drawn at the end of the first growing season. In all cases the soil was similar—"a fine silt loam known as loess" (Holch, p. 263). The plant on the left (A) was growing at the top of a hillside that had previously been cleared for cultivation and subsequently supported some prairie grasses; the acorn from which this seedling grew was planted in an area free of vegetation. It grew rapidly and deeply in this sunny environment with the rich, relatively dry prairie soil. At the end of the season the roots had penetrated the soil to a depth of 5 feet. Other bur oak acorns were planted nearby in a moister and shadier oak-hickory forest that spread out

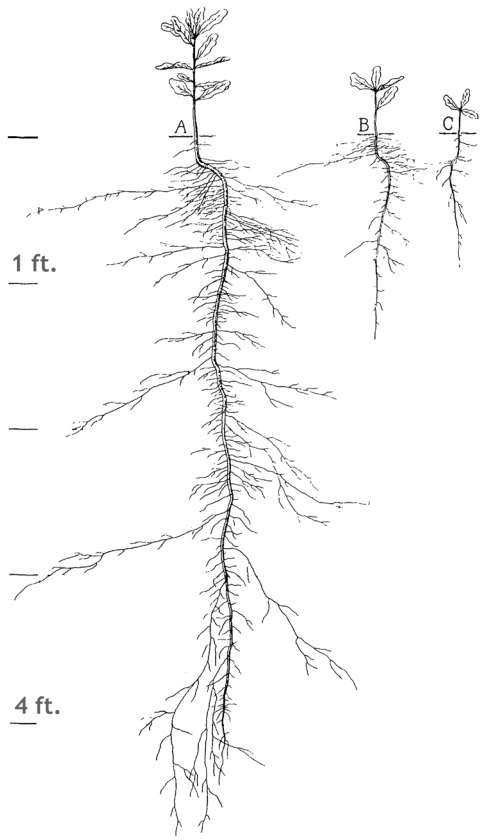


Figure 2. Three different bur oak (*Quercus macrocarpa*) saplings growing in different environments, shown at the end of the first season of growth (after Holch 1931, p. 274).

along a southwest facing slope (B). Here the tap root grew little more than a foot into the soil and formed proportionately fewer side roots. Finally, when the bur oak acorns germinated and grew in a darker, still moister linden (basswood) forest on a north-facing slope, they grew even more slowly and branched little (C). In all cases the above-ground part of the plants remained shorter than the rooting body. But above-ground growth was clearly correlated with root growth: the large-rooted plant also formed a longer main stem (what will become the trunk) with more leaves than the seedlings growing in the shadier, moister conditions.

What this example shows vividly is that by living its life through connecting with a specific place in the world the plant opens itself to the conditions of that place and interacts with them. Because the plant is an open, interactive being, the world it interacts with also becomes embodied in the plant's form and function. In opening itself to what comes to it from the environment and expanding out into that environment, it takes up an active relation to its surroundings, which then become the plant's environment. Place is not only the "location" that can be precisely defined in terms of longitude and latitude. Place for a plant is a web of relations that becomes manifest through the plant's life, substance, and form. The place-as-environment is what allows the plant—in a dynamic sense—to live; it is what the plant interacts with, it provides the plant with what it needs to live, and at the same time it is changed by the life of the plant.

Already in this brief consideration of plant germination and seedling development we see essential and intertwined qualities of plant life: how it embeds itself in a place; how it opens itself to the environment in which it grows; how it transforms itself as it develops from one state to the next while maintaining overall coherence of the organism; how plasticity allows it to develop in relation to different environmental conditions; how it embodies the environment in its forms and functions; how it extends beyond its own "bounds" (think of the mycorrhizal symbiosis) and is a member of a larger living context. All these themes will concern us throughout the following chapters, especially in chapters 3 and 4. Here I want to focus on how we can learn from the plant as a creature of place and from its remarkable openness to its environment. In particular, how can we as human beings develop a more living relation to the world?

## *Becoming Rooted — Perception*

> It seems as if the day was not wholly profane, in which we have given heed to some natural object. The fall of snowflakes in a still air, preserving to each crystal its perfect form; the blowing of sleet over a wide sheet of water, and over plains, the waving rye-field, the mimic waving of acres of houstonia, whose innumerable florets whiten and ripple before the eye; the reflections of trees and flowers in glassy lakes; the musical steaming odorous south wind, which converts all trees to windharps; the crackling and spurting of hemlock in the flames; or of pine logs, which yield glory to the walls and faces in the sitting-room,—these are the music and pictures of the most ancient religion. (Ralph Waldo Emerson, from his essay 1844 essay "Nature" (1990, p. 312))

In these descriptions Emerson shows us that he has "given heed" to the world around him. Actually, to say "around" him is not correct. In perceiving these occurrences he was out with them and took them in; he participated in them. Only then could he describe his experiences of nature so concretely as moving, unfolding processes. In such meetings with the sense world Emerson experienced something deep—the day is not "wholly profane"—and he intimates an "ancient religion," a reconnecting with the roots of existence.

Most of us have experienced immediate and deeply enlivening meetings with the world—the smile of a young child; the rainbow arching across the light-bathed sky; the glowing red and orange clouds of a sunset; the waves building, breaking, crashing, and running up onto the beach. Such experiences are powerful and yet fleeting; we know ourselves as affected by them—we have met something and been nourished by something greater than ourselves. The experiences I've mentioned are special ones; they are not necessarily day-to-day occurrences. And yet, most of the waking day we are in the process of perceiving in some way or another.

But everyday experience becomes "merely everyday" and loses vibrancy inasmuch as it shrinks into intellectual thoughts, interpretations, biases, and categorizations of experience. Often we only notice something insofar as we already know it. I see a "dandelion," but how much of its radiant yellow do I really take in and acknowledge? I see the "pond," but I don't notice the undulating waves or the reflections of the trees and the sky quivering on its surface and extending into its depths. In one important way our experience is deadened because our perception has narrowed to what we already know. The world becomes prosaic, a world of things that is scarcely alive with the music of a resounding world.

A plant opens itself to its environment as a prerequisite for unfolding its life. It puts itself out into the environment. This openness to the environment does not end once it has germinated and established itself as a seedling. The roots continue to grow and near the tips remain in active interplay with the environment. The leaves spread out, new ones develop, and interaction with light and air do not cease. As vital organs the roots and leaves don't stop being open and close off from the environment, saying, physiologically, "We've had enough interaction." So the plant's openness to the environment entails initial receptivity, the activity of expanding out and ramifying into the environment, and the ability to remain receptive as it continues to interact with the environment.

These are also the fundamental gestures of human perception. When I am immersed in thought and then a pileated woodpecker hammers into a tree in the nearby woods, my attention is drawn out. I live for a moment in the sound and in its reverberation through the trees. In being in the sound I'm receptive. In fact, at that moment there is no "I am here" and "the bird is over there." There is simply the sounding in which I am participating. I am changed and grow richer through this experience.

I suggest that a prerequisite for gaining a living relation to the world as human beings is the ability to open ourselves through attentive perception. This living relation begins when we go out, actively and yet in the mode of receptivity, take in, and then engage with what we discover. In the process we become beings of place, even if we are on the move. We are attending to and taking in some of what the world offers up. In contrast, we are placeless when we are caught up with or consumed with ourselves, when we notice only what we have known before. If we want to open ourselves and root ourselves in the world in a living way, we need to develop pathways to get out into experience, to become more conscious of immediate experience, and to learn to work with our ideas in such a way that they do not place barriers between ourselves and the richness of the world.

So a key issue is: how can we become more open and remain open to the richness of the world? Can we learn from the plant a way of being and, to paraphrase Schiller, do willfully what it does organically? This demands a kind of active wakefulness on our part to "be there." Or we could say: we must develop presence of mind as a kind of peripheral attentiveness, a readiness to take in. This is no simple matter and certainly, for me, not a given. It is a skill to be developed.

*In subsequent sections of the chapter I describe a number of different ways "to get there from here," most of which are based on adult education courses at The Nature Institute.*

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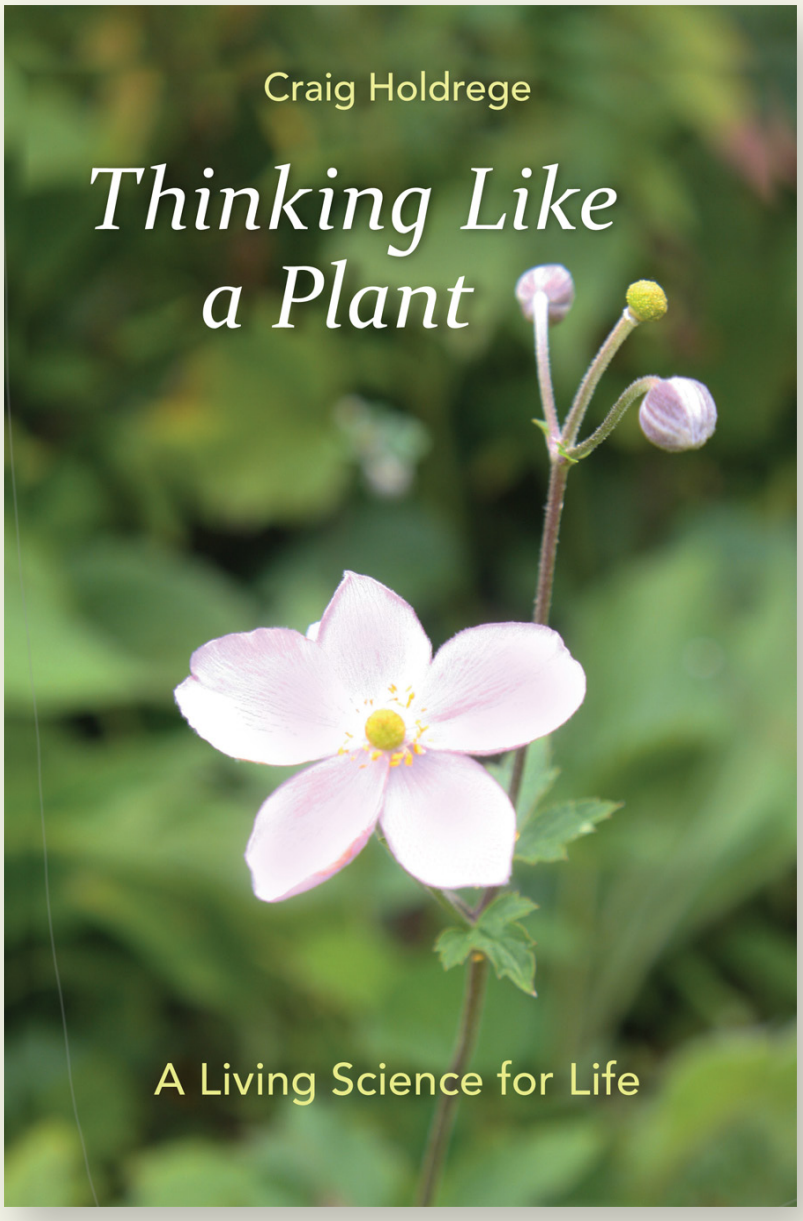


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# Upcoming Events at The Nature Institute

## Celebrating the Completion of the New Building

### *Why Goethean Science?*

A talk in celebration of the new building, by Craig Holdrege and Henrike Holdrege

*Saturday, May 25, 7:30 pm*

### *Festive Open House*

Beginning promptly at 11 am: music, a few words, building tour, refreshments

*Sunday, May 26, 11 am to 1 pm (Please RSVP by May 20)*

## Evolution: Learning to Understand Life in Development

*June 23 – 29, with Craig Holdrege, Henrike Holdrege, and Nathaniel Williams*

You can find more information about the course and a registration form on our website: http://natureinstitute.org/calendar. Or call us at 518-672-0116.

## Earth, Water, Air, Warmth

*July 7 – 13, with Henrike Holdrege and Laura Summer*

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