



In Context

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#28



The Nature Institute

Dear Friends,

The Nature Institute is dedicated to research and education. Research, we always say, is our highest priority; we never intended simply to become another school. Craig's dream, while still a high school science teacher, was to found an organization that would support scientific research of a phenomenological sort—which, incidentally, would provide content for educators.

Or not so incidentally. As this issue of *In Context* illustrates so well, research activities can hardly be separated from educational ones, just as educational activities presuppose research. In his feature article, Craig shows to what an extraordinary degree the effective teacher must be growing and learning—doing a kind of science—in the very act of teaching. Every student represents a great unknown, and it is the teacher's job to come to understand the student's capacities as fully as possible, and to encourage their unfolding. And because there is an element of freedom in every student, the teacher, like a good scientist, must be receptive to yet-unrecognized possibilities, must be open to many points of view, and must exhibit in his or her interaction with the student the kind of potential for change, growth and ever-deepening insight that is the deepest lesson and inspiration for the student.

The article, "Toward a Biology Worthy of Life," describes a major research project Steve has been engaged in during the past few years. The research has been fruitful, and yet we have been fully aware that this is not enough. Research is not of much use if it cannot be made widely available to those who would find it of interest. This has been partly achieved through publication in various venues, including the influential journal, *The New Atlantis*, and a chapter in a book published by Harvard University Press (see page 8). But more is needed. Therefore we have launched a web-based project—now in its initial but still fairly ambitious phase—to put the results of this research into a form accessible to readers with different interests and different levels of technical expertise, from scientists to laypeople. This kind of educational outreach also facilitates exchange with other researchers, which in turn furthers the investigative work itself.

And, of course, there is the matter of "physical plant." Our new building annex, with a large classroom and research/workspaces, is also described in this issue of *In Context*. (There are pictures on page 11.) The new structure will enable us to expand both our educational and research activities.

But perhaps we should have begun by saying "The Nature Institute is dedicated to research, education, and collaboration with a community of friends." For none of our work would have been possible without your collaboration in all its various forms, for which we are deeply grateful.

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Toward a Biology Worthy of Life

Stephen L. Talbott

For over three years now, I've been writing a series of articles aimed at characterizing the organism as it is being sketched by current work in molecular biology – especially genetics, epigenetics, and gene regulation in general. This has seemed necessary because the truth emerging from this work is so dramatically at odds not only with the scientific reporting available to the general public, but also with the machine metaphors and materialistic assumptions of the researchers themselves. A number of my articles have been published in the influential journal, *The New Atlantis*, and have also been picked up in other venues.

I have worried, however, that the length, technicality, and general “heaviness” of the articles limits their audience. This seems particularly unfortunate because the responses I have received to the articles – for example, from interested laypeople and from teachers and other professionals desiring to understand current developments in molecular biology – have been extremely positive. We at the Institute have therefore decided to undertake a major project intended to bring this ongoing work to a wider public. By the time you read this, we expect to have the initial phase of this web-based project in place at <http://nature-institute.org/txt/st/org>. It is entitled, “What Do Organisms Mean? — Toward a Biology Worthy of Life.” (Some articles were originally published under the heading, “On Making the Genome Whole.”)

The idea is to present and re-present the work in a variety of ways, with various alternatives for browsing the material according to one's interests, scientific background, and available time. We want a fascinating collection of web pages that will draw viewers from around the world and from many walks of life. And we want to supply ample supporting and supplemental information, ranging from highly technical to popular, from undisputed to controversial — to begin with, a glossary of technical terms contained in the texts. We think the website has the potential to become a major resource for both professionals and the general public.

You'll find an approximate image (in black and white) of the beginning of the introduction to the new website on the following page.

A Sample of the Content

One way to browse the website is by going to a section of selected excerpts from the major articles. The excerpts — of which there are currently over one hundred — are organized by topic. One can immediately jump from any one of the excerpts to its location in the article from which it is taken. Obviously, we cannot include this feature in a hardcopy publication, but we can at least give you a taste of the material by providing a group of excerpts below relating to one of the topics: “Contextuality, plasticity, and wholeness.” (The source article is listed at the end of each excerpt below.)

An overall pattern governs its own parts

In the very young embryo a given cell can be moved from one place to another, resulting in a completely different fate for that cell within the developing organism. This indicates that the cell's fate is determined “on the fly”: a governing dynamic disposes of each part according to the needs of the overall pattern. The developing relations between the individual cells are more a result of than a cause of the order of the whole.

Evidently, besides its full complement of “genetic information”, each cell needs still additional “topical information” derived from the field structure of the collective mass. How otherwise could any unit know just what scrap from its full grab bag of inside information to put to work at its particular station in order to conform to the total harmonious program design? Clearly, left solely to their own devices, the individual cells and their entrapped genomes would be as incapable of producing a harmonious pattern of development as a piano with a full keyboard would be of rendering a tune without a player. (Weiss 1973, p. 35)

It is crucial to realize what Weiss is *not* saying. He is not saying that the laws of physics are violated in the formation of organic patterns. He himself spent many years elucidating the play of physical forces in such situations. What is being coordinated is nothing other than this play



After Crick and Watson unraveled the structure of DNA, molecular biologists were destined, so they thought, to understand organisms as physical mechanisms and nothing more. Instead, ever more sophisticated experimental techniques have been revealing organisms of meaning whose wisdom and subtlety, whose powers of development and adaptation, whose perceptive insight and effective communication, and whose evolutionary ingenuity far outstrip our current capacities for comprehension. Yes, new molecular “mechanisms”, isolated from the organism as a whole,

continue to be proclaimed daily. But when we restore these products of our one-sided methods to their living contexts, allowing them to speak their own meanings, what they actually show us is this: every organism is intent upon pursuing the eloquent story of its own life. Its purposes govern and coordinate the lawful physical performance of its body, not the other way around.

No, you have probably not heard about these developments in the technical world of molecular biology; they don't make the pages of the *New York Times* or even *Scientific American*. Indeed, many biologists themselves lament that their unavoidable focus on the minutia of their own narrow research topics prevents their paying adequate attention to wider fields of discovery. But the reality now being proclaimed from the pages of every technical journal could hardly be more dramatic. Perhaps the central truth is this: we human beings discover our conscious, inner capacities — our capacities to think and mean, to plan and strive — unconsciously and objectively reflected back to us from every metabolic process, every signaling pathway, every gene expression pattern in all the organisms we study. We are akin to these organisms in ways we have long forgotten. This matters in a world whose future has been placed in our hands. No form of life is alien to us.

You deserve to know what is going on — not via the heated and fruitless rhetoric of the science–religion wars, and not through vague, “Age of Aquarius” references to vibrations, energy fields and quantum mysteries, but rather directly from molecular biologists themselves. That's what this project is about. I call it:

What Do Organisms Mean? *Toward a Biology Worthy of Life*

Stephen L. Talbott

Organisms are creatures of meaning. Biologists imply as much — whether or not they pay any attention to the fact — when they employ standard technical terms such as “information,” “code,” “message,” “signal,” “program,” “response,” “communication,” and so on. No one would call something a “message,” for example, if they were not imagining a cognitive and intentional content. In biological usage, *all* these words similarly rely upon our taking them as pointers toward the language-like and meaningful. And if the organism's life is a life of meaning, we would do well to allow it to speak for itself.

Our growing awareness of the speech-like meaning of the organism is leading us inexorably toward a *new science of biology*. The literature today, at least around its edges, is rife with hints of creative thinking and new directions that would have sounded revolutionary and unthinkable a few decades ago. My aim here is to bring some of the current and unexpected trends in biology to a wider audience, piecing together a broader picture that shows us what the biology of the future may look like, particularly as we can glimpse it through the work of molecular biologists wrestling with the problems of genetics, organismal development and evolution.



of forces. His point is that, whatever the level we analyze, from macromolecular complexes, to organelles, to cells, to tissues, to individual organs, to the organism as a whole, we find the same principle: we cannot reconstruct the pattern at any level of activity by *starting from the parts and interactions at that level*. There are always organizing principles that must be seen working from a larger whole into the parts. [From “The Unbearable Wholeness of Beings”]

Unexpected plasticity of the genome

Pluripotent cells such as stem cells, which bear certain similarities to germline cells, possess genomes that are “amazingly plastic”: “The incredible plasticity of pluripotent genomes is a notable discovery, and reveals the view of an unexpectedly dynamic mammalian genome for many of us” (Blasco et al. 2011). [From “Natural Genome Remodeling”]

The direction of molecular biological research

Is there any subdiscipline of biology today where research has been reducing cellular processes to a more clearly defined set of causal mechanisms instead of rendering them more ambiguous, more intentional, more plastic and context-dependent, and less mechanical? [From “The Unbearable Wholeness of Beings”]

Of cross-talk and “horror-graphs” (1)

In the conventional machine model of the organism, signaling pathways were straightforward, with a clearcut input at the start of the pathway leading to an equally clearcut output at the end. Not so today, as a team of molecular biologists at the Free University of Brussels found out when they looked at how these pathways interact or “crosstalk” with each other. Tabulating the cross-signalings between just four such pathways yielded what they called a “horror graph,” and quickly it began to look as though “everything does everything to everything” (Dumont et al. 2001). In reality, we see a “collaborative” process that can be “pictured as a table around which decision-makers debate a question and respond collectively to information put to them” (Levy et al. 2010). This directed, corporate decision-making is not the stuff of mere physics and chemistry. [From “The Unbearable Wholeness of Beings”]

Of cross-talk and “horror-graphs” (2)

Our problem lies in adequately imagining the reality. When a single protein can combine with several hundred different modifier molecules, leading to practically infinite combinatorial possibilities, and when that protein itself is an infinitesimal point in the vast, turbulent

molecular sea of continual exchange that is the cell, and when the cell is one instance of maybe 100 trillion cells of some 250 different major types in the human body, from muscle to bone, from liver to brain, from blood to retina — well, it’s understandable that many researchers prefer not to stare too long at the larger picture. Nevertheless, we should keep in mind that the collaborative process mentioned above involves not just one table with “negotiators” gathered around it, but countless tables with countless participants, and with messages flying back and forth in countless patterns as countless “decisions” are made in a manner somehow subordinated to the unity and multi-dimensional interests of the organism as a whole. [From “The Unbearable Wholeness of Beings”]

Of cross-talk and “horror-graphs” (3)

Whenever we imagine a biological process aimed at achieving some particular result, we need to keep in mind that every element in that process is likely playing a role in an indeterminate number of other significant, and seemingly goal-directed, activities. The mystery in all this does not lie primarily in isolated “mechanisms” of interaction; the question, rather, is why things don’t fall completely apart — as they do, in fact, at the moment of death. What power holds off that moment — precisely for a *lifetime*, and not a moment longer? [From “The Unbearable Wholeness of Beings”]

Controllers that don’t exist

When regulators are in turn regulated, what do we mean by “regulate” — and where within the web of regulation can we single out a *master* controller capable of *dictating* cellular fates? And if we can’t, what are reputable scientists doing when they claim to have identified such a controller, or, rather, various such controllers?

If they really mean something like “influencers,” then that’s fine. But influence is not about mechanism and control; the factors at issue just don’t have controlling powers. What we see, rather, is a continual mutual adaptation, interaction, and coordination that occurs *from above*. What we see, that is — once we start following out all the interactions at a molecular level — is not some mechanism *dictating* the fate or *controlling* an activity of the organism, but simply an organism-wide coherence — a living, metamorphosing form of activity — within which the more or less distinct partial activities find their proper place.

The misrepresentation of this organic coherence in favor of supposed controlling mechanisms is not an innocent inattention to language; it’s a fundamental misrepresentation of reality at the central point where we are

challenged to understand the character of living things. [From “The Unbearable Wholeness of Beings”]

Contextuality turns causality upside down

To realize the full significance of the truth so often remarked in the technical literature today — namely, that context matters — is indeed to embark upon a revolutionary adventure. It means reversing one of the most deeply engrained habits within science — the habit of explaining the whole as the result of its parts. If an organic context really does rule its parts in the way molecular biologists are beginning to recognize, then we have to learn to speak about that peculiar form of governance, turning our usual causal explanations upside down. We have to learn to explain the part as an expression of a larger, contextual unity. [From “Getting Over the Code Delusion: Biology’s Awakening”]

Causes are lifted into the service of the organism

We find in every organism a *meaningful coordination* of its activities, whereby it becomes a functioning and self-sustaining unity engaged in a flexible and well-shaped response to the infinitely varying stimuli of its environment. By virtue of this coordination, every local or partial activity expresses its share in the distinctive character of the whole. The ability of the organism to pursue its own ends amid an ever-shifting context means that causal relations become fluid and diffuse, losing all fixity. They are continually subordinated to, or lifted into service of, the agency of the organism as a whole. [From “The Unbearable Wholeness of Beings”]

Its life all the way down

The one decisive lesson I think we can draw from the work in molecular genetics over the past couple of decades is that life does not progressively contract into a code or mechanism or any other reduced “building block” as we probe its more minute dimensions. Trying to define the complexity of the chromosome, according to geneticists Shiv Grewal and Sarah Elgin, “is like trying to define life itself”. Having plunged headlong toward the micro and molecular in their drive to reduce the living to the inanimate, biologists now find unapologetic life staring back at them from every chromatogram, every electron micrograph, every gene expression profile. Things do not become simpler, less organic, less animate. The explanatory task at the bottom is essentially the same as what we faced higher up. It’s rather our *understanding* that all too easily becomes constricted as we move downward, because the contextual scope and qualitative richness of our survey is so extremely narrowed. [From “Getting Over the Code Delusion: Biology’s Awakening”]

Eat to Regulate Your Genes?

As you may have learned in biology class, a protein-coding gene is a segment of DNA that can be “transcribed” into messenger RNA, which then is (or may be) “translated” into protein. The entire process is broadly known as “gene expression.” However, one of the hottest fields of research in molecular biology over the past decade or two has to do with DNA regions that produce a wide assortment of non-protein-coding RNAs. These noncoding RNAs perform a wide range of regulatory functions in the cell. And one of the most important classes of these regulatory molecules consists of what are called “microRNAs,” or miRNAs. Their manifold functions primarily have to do with the regulation of gene expression, and their activities are interwoven with almost every aspect of an organism. Likewise their malfunctioning: the presence of the wrong miRNA in the wrong place at the wrong time contributes to many diseases, including cancers.

It has long been regarded as impossible for an miRNA ingested in an animal’s food to function as an miRNA in that animal. Avoiding degradation, getting from the digestive tract into the bloodstream, and moving from the bloodstream into tissues and organs—these seemed to be insurmountable barriers. But researchers have now brought the startling and wholly unexpected news that animals, including mammals, can assimilate in functional form at least some of the miRNAs they ingest from food. For example, plant-derived miRNAs have been identified in the blood serum and tissues of mice. One of these miRNAs was found to regulate gene expression in such a way as to affect levels of low-density lipoproteins in the mice. That same plant-derived miRNA is present “at a relatively high level” in human serum. The researchers (Zhang et al. 2012) conclude that “plant miRNAs in food can regulate the expression of target genes in mammals.”

Commenting on the implications of this research, another team of biologists write: “For decades there have been debates on the safety of transgenic [genetically engineered] food with regards to human health and the environment. This profound discovery by Zhang et al. should make decision takers more cautious when considering the issues that may arise from the consumption of transgenic crops.” (Jiang et al. 2012)

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Coming to Our Senses

Thirteen science teachers met for a week in July to explore human sensing and its importance in science education. There was a mix of experienced and new teachers. Through a variety of exercises we engaged in active sensing that helped us to become more aware of the qualities that are revealed through particular senses. So, for example, we spent time exploring balance (see photo). We also carried out an exercise in which we described a variety of objects that we perceive with our hands, but with eyes closed. Many facets of texture, density, warmth, and form revealed themselves. We noticed how often we ignore these gateways into the world because we focus so strongly on what we see, and we are usually guided in our seeing by the definite concepts we have formed for objects. By practicing using our other senses, we become more open to the various qualities of things.

We realized that when we truly enter into sensing, the world opens up in its manifoldness and shows itself to be full of riddles. The world is always fresh in our sensing. Returning again and again to sense experience (that is, “coming to our senses”) is a way to practice what John Keats called “negative capability”:

... And at once it struck me what quality went to form a Man of Achievement, especially in Literature, and which Shakespeare possessed so enormously—I mean Negative Capability, that is, when a man is capable of being in uncertainties, mysteries, doubts, without any irritable reaching after fact and reason...

One of the memorable events during the course was watching the sunrise from a field at Hawthorne Valley Farm. We met at the farm at 4 a.m. and walked, without flash lights, up onto the field. Jupiter and Venus shone brilliantly above the eastern horizon. Over the next hour and a half we quietly took in—our senses went out to—the coming of the day with all the associated transformations of sound, temperature, moisture, color, and feeling of space.

During the course, we discussed from a pedagogical perspective how important it is to let the students immerse themselves in sense experience. Out of these encounters, riddles arise and the need for more observation becomes clear. In this process a pathway to understanding guided by thinking opens up. It is not a pathway toward quick answers, but rather toward enriched appreciation of the world.

Here and There

- In April Henrike gave an evening talk at The Nature Institute on the location and movement of stars and planets in the springtime.
- Craig participated in a conference on “Spiritual Values in Higher Education: Contemplative Inquiry in Teaching, Learning and Research” in May at Amherst College. There were a number of presentations concerned with contemplative inquiry, and there was ample time for stimulating conversation with presenters and participants.
- In June Craig led members of the steering committee for teacher education of the Association of Waldorf Schools of North America in a session on “Morphological Thinking.” This served as the preparation for the group’s weekend gathering in Harlemlive, New York.
- At the end of August Craig and Henrike went to the Ridge and Valley Charter School in Blairstown, New Jersey. The K-8 school has a focus on experiential education and learning from nature. It aims to “promote values of respect, reverence, gratitude, and care for Earth and all living beings.” Craig and Henrike conducted an all-day “Exploratory Learning and Understanding” workshop with the school’s staff and faculty. You can’t productively talk about exploratory learning without having done it. So together we carried out observations and experiments concerned with colors in nature such as the blue sky, which are not pigment-based, and spectral colors (as they appear in prisms and rainbows). After doing some work, we would reflect on the phenomenological method we

were using: observing, comparing, and relating similar phenomena to one another. We also discussed the problem of using abstract models to “explain” phenomena—explanations that often have the effect of distancing children from the world they are trying to understand.

- A Symposium on “Living Questions Research” was held September 20–23 at the Threefold Educational Center in Chestnut Ridge, New York. Craig gave an introductory talk that considered the nature of questioning in the process of inquiry. He also gave a talk on “My Pathway in Goethean Phenomenology.”

- Following the symposium, Craig and Henrike held a week-long course entitled “A Pathway to Living Knowledge.” The course focused on the nature of phenomenological inquiry. We worked with the theme of “inner and outer,” which we approached through different exercises and explorations that ranged from pure thought in geometry to detailed observation of natural phenomena. There were eleven participants who came from as far away as Hong Kong and the United Kingdom.

- In October Henrike traveled to Germany and participated in a conference on “What is the Reality of Atoms: 100 Years since Bohr’s Atomic Model.” The conference, held in the German language, gave her the opportunity to hear talks and participate in workshops from scientists and science educators.

- During October and November, Henrike gave a series of workshops locally on “Goethean Explorations of Perspective and Light and Color.” The workshops are part of the Free Columbia Art Course.

- Leading up to the Biodynamic Farming and Gardening Association’s November annual conference in Madison, Wisconsin, Craig will participate in two different events. At the Mentor Farmer Gathering of the Association’s apprenticeship program (held at Angelic Organics Farm and Learning Center in Caledonia, Illinois) he will lead an observational workshop, “Cultivating Awareness and Observation: Practical Exercises,” and then introduce and lead a conversation on the topic, “Biodynamic Farming and the Development of the Human Being.” Following that, he will contribute to an all-day workshop on “Seeds and Breeds: Breeding for the Future of Agriculture.” Other contributors in the workshop are Walter Goldstein (Mandaamin Institute, Julie Dawson (Cornell University), Harald Hoven (Rudolf Steiner College) and Dana Burns (Healing Traditions Veterinary Services).

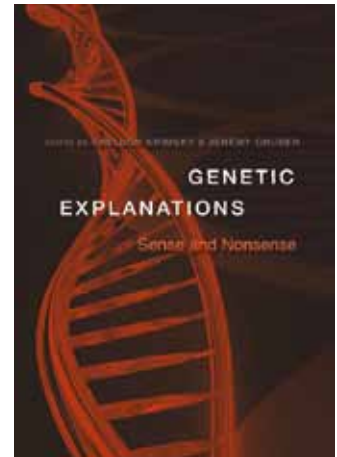
- On November 11 Jonathan Talbott and Seamus Maynard—a regionally well-known violin and guitar duo—gave a

benefit concert for The Nature Institute at Hawthorne Valley School, near the Institute.

For news about upcoming events, you can always check our website!

A Long Time Coming!

In the last couple of issues of *In Context*, we’ve mentioned the forthcoming book from Harvard University Press, with a chapter by Steve entitled, “The Myth of the Machine-Organism: From Genetic Mechanisms to Living Beings.” The book is still not released, but at least we now have the cover image shown here and also a firm availability date: January 14, 2013.



Steve finds himself in illustrious company between the covers of this book, which is entitled *Genetic Explanations: Sense and Nonsense*. That company includes, preeminently, Harvard biologist, Richard Lewontin, who wrote the foreword, and Lewontin’s Harvard emerita colleague, Ruth Hubbard, who pioneered criticism of the modern gene concept with her bestselling book, *Exploding the Gene Myth* (1993). Hubbard’s chapter in the current book is on “The Mismeasure of the Gene.”

The book has three sections: New Understanding of Genetic Science (where Steve’s paper is chapter 5); Medical Genetics; and Genetics in Human Behavior and Culture. Intriguing chapter titles in the Medical Genetics section include “Some Problems with Genetic Horoscopes,” “Cancer Genes: The Vestigial Remains of a Fallen Theory,” and “The Fruitless Search for Genes in Psychiatry and Psychology.” You’ll find the complete list of sixteen chapters and authors at the Harvard University Press website: <http://www.hup.harvard.edu/catalog.php?isbn=9780674064461>.

Incidentally, you will find the essential contents of Steve’s book chapter, expanded into three long articles, on the Nature Institute website: <http://natureinstitute.org/txt/st/org>. The articles corresponding to the Harvard book chapter are “Getting Over the Code Delusion,” “The Unbearable Wholeness of Beings,” and “From Physical Causes to Organisms of Meaning.”

See the main article in the Notes and Reviews section of this *In Context* for more about the project of which these articles are a part.

The World of Color and Light

Seventeen participants from across the U.S. and the U.K. gathered for our public summer course to study the light-filled and colorful world. We engaged in nature observation, experiments and painting, as well as in conversation about Goethe's method of research.

One participant, Amie Slate, described the course in the following way:

“Experiencing the unfolding color phenomena was exciting and fascinating. To begin our experiencing of color and light, the first thing we did was go into an absolutely dark room. We sat together in the dark, in silence for five or ten minutes. Can you imagine? Here we are in a color course and the first thing we do is go sit together in the dark in silence. Since we don't experience color and light (in the usual sense) in darkness, perhaps you can get an idea of what we were experiencing — our own eyes and our own thinking. From this very first exercise and throughout the course, we experienced how to develop our capacity for sensing and thinking, and indeed, for entering into the phenomena with ourselves. Our capacity for sensing was made a wholesome and necessary part of understanding the world. That is in itself quite phenomenal!

“After each exercise, there was some kind of review (also with a kind of growing order in it). The day was well organized with different types of activities that all related to each other in a living way. Each exercise built on the previous ones. It was so lovely how no theory was used to frame the experiences. They were really free to unfold, unconstrained by prior ideas and expectations.

“We had several more experiences in the dark room, seeing how light enters that space and begins to shape and reveal form and color. We were given a fascinating experience of inside/outside — it was, you could say, just like being inside the eye itself. We progressed through experiences of color in a large number of categories in a way that allowed them to feel well-ordered. Every afternoon we did painting of color wheels. Though I have done color wheels in the additive world with my computer graphics, I had never done it with the subtractive colors (paint). It was enlightening to do this very structured color blending and see the magical but ordered and lawful appearance of the colors.

“The way Craig, Henrike and Nathaniel worked with this newly-met group of twenty people was very exciting for me. I suppose in Waldorf or Goethean environments, it is not so unusual. But in my field, with my education and upbringing, it is not typical at all. I watched them make space for the sensing and thinking of each person to be made visible. And even more importantly, they managed to hold the space and us skillfully enough that our separate contributions added up to something more, something that was, in the end, not reachable in any other way. For me, this was a very inspiring experience and I hope to do more of it.”



Supporting The Nature Institute: Planned Giving

The work of The Nature Institute is supported by many individuals and organizations, and has been since its founding. These supporters are, in a very real sense, co-creators and participants in the Institute's mission. The tasks before all of us now include planning for the future, not just the coming year, or five years, but longer...perhaps even well beyond the lifetimes of those of us reading this issue of *In Context*.

The Institute has benefited enormously from the generosity and thoughtfulness of many individuals. For example, Seyhan Ege bequeathed a sum of money to The Nature Institute that, upon her passing, assisted us in going forward with a much needed expansion of the Institute's facilities.

Did you know there are ways to support The Nature Institute that will not affect your current income or your family's financial security? You can arrange a gift that costs you nothing during your lifetime, a gift that leaves your cash flow and current financial planning unchanged.

Recently, two long-time supporters informed us of their decision to identify The Nature Institute as a beneficiary in their wills. One friend of the Institute commented on how easy it was to name the Institute as a secondary beneficiary in a retirement annuity, in the event his wife (the primary beneficiary) predeceased him.

We want to share some of the ways you can consider supporting the Institute right now, and well into the future, even if that gift is not realized for 10, 20, or more years.

BEQUESTS

When you decide to leave assets in your will to support the work of The Nature Institute, you are making a bequest. You may decide to leave a specific amount or a portion of your estate to The Nature Institute. We are able to provide your attorney with the appropriate language to include in your will.

RETIREMENT ACCOUNTS AND LIFE INSURANCE POLICIES

Identifying beneficiaries for retirement accounts or life insurance policies can be very easy to do and usually does not require an attorney.

For some people today, retirement accounts are significant assets. These might include IRAs, 403b plans, annuities, or pensions. Moreover, some people have life insurance policies that they have purchased or received through affiliation with an organization such as a professional society or labor union.

Such financial arrangements typically allow the individual to designate a primary and secondary beneficiary as the recipient upon your passing. (A secondary beneficiary would receive the funds only if the primary beneficiary has already passed on.) Naming The Nature Institute as the primary or secondary beneficiary on your retirement accounts can help you to make a significant future contribution, while maintaining your current financial status.

Similarly, you can name the Institute as a primary or secondary beneficiary of a life insurance policy, and/or you also can transfer ownership of the policy to The Nature Institute during your lifetime.

STOCKS, BONDS, AND MUTUAL FUNDS

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We realize that many of our most ardent and dedicated supporters do not have the financial and material resources to support the Institute as they might prefer. We always welcome the enthusiasm and positive energy of such individuals; they are contributing in a vital, living manner that should never be underestimated!



Removing the previous entryway to our building on August 13



Excavation for the new wing



Building the walls of the lower level; the walls are made of 14-inch thick insulated blocks that consist of concrete-bonded recycled waste wood fibers. Once the blocks are stacked, the core is filled with concrete.



The walls for the upper story go up. The walls are framed with a double row of 2x4 studs, so that they are 9 inches thick and form no thermal bridge. They will be insulated with cellulose.

The Building Expansion *What Can Happen in 7 Weeks*



By the end of September the outer shell was nearly finished and we could experience the building in its final size and proportion. It's a beautiful structure and we aim to be using it by February.

Thank You!

We are grateful to all our friends who have contributed money, services, or goods to The Nature Institute between April 1, 2012 and September 30, 2012. You make our work possible.

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Education and the Presence of the Unknown

CRAIG HOLDREGE

This article grew out of a talk “What is Education For?” that I gave at the 4th International Refresher Week in March 2012 at Kassel Teacher Training College in Germany. This course was attended primarily by high school teachers in Waldorf schools and individuals training to become Waldorf high school teachers. There were participants from over 20 different countries.

Most parents are deeply concerned about the education of their children. They want their children to become capable individuals who live satisfied lives and who are productive in their chosen professions. They feel that school education should facilitate this development: it should give students the knowledge and skills to master life and to find and thrive in a good job.

Nevertheless, parental thinking about “what is education for?” tends to shrink toward the short term. Are you preparing my teenager for college? This direction of thought often manifests itself when the students are in 7th or 8th grades and leads the parents to wonder whether they should send their students to a different high school, which they sometimes do.

In such a frame of mind, thinking about education becomes narrow. Each stage of the educational process becomes the preparation for the next: kindergarten prepares for elementary school, which prepares for middle school, which prepares for high school, which prepares for college, which prepares for a profession. When curricula are developed out of this perspective, the tendency is to bring what is perceived as needed at a later stage into an earlier one. A public school teacher in the U.S. may now receive training to teach her students how to use PowerPoint in the 2nd grade! Why? Well, they will need to do their middle school reports using PowerPoint so they need to be prepared. And why should they do PowerPoint in middle school? They need it for high school...

Or, in public high schools there are advanced placement courses so that the students are better prepared for college and can even skip some college courses. In reality, students often go over the same subject matter again in college courses. Or even worse, as a university chemistry professor once told me: “I need to help students who have taken

advanced placement courses unlearn what they think they know so that they can actually learn to think like chemists!”

U.S. President Barack Obama’s education webpage offers a clear message about the goals of education:

A world-class education is the single most important factor in determining not just whether our kids can compete for the best jobs but whether America can out-compete countries around the world. America’s business leaders understand that when it comes to education, we need to up our game... . The President will reform America’s public schools to deliver a 21st Century education that will prepare all children for success in the new global workplace. President Obama’s [plan] fosters critical thinking, problem solving, and the innovative use of knowledge to prepare students for college and career, helping America win the future by out-educating our competitors... (<http://www.whitehouse.gov/issues/education>; downloaded May 3, 2012)

Here the goals of education are framed solely in terms of economic success and national interests—students must serve the economic engine that drives the U.S. in its efforts to out-compete the rest of the world. This is a crass perspective, but it also indicates a pulse of our times, when educational policies focus increasingly on specific outcomes.

When education is mainly viewed as preparation for a next stage of education, for a particular professional outcome, or for furthering national interests, then the student must be molded to fit a particular system. We make the future—as the goal to be reached—into something specific and bounded that we can get a grip on. I will call this the abstract future.

The Unknown Future

But the abstract future is not the real future. The future is something unknown; it is full of surprises. If you reflect on some of the most important events in your life—ones that evoked growth and development, that allowed something new to happen—they were probably not events that school explicitly prepared you for. Were you taught how to find your life’s partner in school, or prepared for that moment in

your life when your first child is born and your life radically changes? Even if someone had told you about the transforming effects of such an event, the actual experience is something wholly other than hearing about it.

Or think of cultural change. Who would have imagined 50 years ago that the book of an unassuming scientist would help ignite a new kind of environmental awareness? I mean Rachel Carson and her book *Silent Spring*. Which educational institutions in the late 1950s and early 1960s were preparing students to be receptive to what Rachel Carson presented? The reception of her book was a surprise, unexpected and exceedingly important.

The future is not an extension of the past; new things do happen. So if we, as educators (and I include here parents as well), think mainly about preparing students for later life viewed as an extension of the status quo, then we are ignoring some of the most vital aspects of human life.

Moreover, who could possibly want the future to be a continuation of the present? Who wants environmental degradation, poverty, or war to continue?

So as educators we have a conundrum. It is fairly straightforward, at least superficially, to prepare students for an exam, to teach them content they might need to know. They can learn to perform a sequence of actions to make something, or become reasonably skilled in a particular discipline (auto mechanics, an academic field with its particular forms and methods, disease diagnosis, and so on). We know that this kind of preparation has its place.

But what about preparing for an unknown future, for the future we cannot imagine? How might we craft educational programs that help students develop capacities for creating a future that we can't see? That is hardly easy, and may even seem impossible. However, it's what I want to focus on here.

A few years ago I gave a talk at a high school graduation ceremony in a Waldorf school. In considering what I would say in this brief talk, I knew that I didn't want to say, "I hope the school has prepared you well for college or for life." Since you have just read what I wrote, you know why. In one moment it came to me: no, the goal is different. I need to say: "My hope is not that the school has prepared you for present-day culture and its existing forms and processes. Rather, my hope is that you have been educated in such a way that the world is not prepared for you. I hope you have not been hindered and that you may even have been nurtured and encouraged to develop ideas and to do things that no one expects—not in order to be different, but because



Fourth grade students learning PowerPoint

you sense what needs to happen." I added, "don't listen to people who tell you, when you are following a yearning or birthing an idea, that can't be done."

In a similar vein Rudolf Steiner wrote about the goals of education in an essay he published shortly before the founding of the first Waldorf school in 1919:

What we teach and how we educate should be derived only from our knowledge of the becoming human being and his or her individual potentials. A true science of the human being should be the basis of education and instruction. We shouldn't ask: What does a human being need to know and to master for society as it exists? Rather: What are a human being's predispositions and potentials for development? Then it will be possible for each generation to infuse ever new impulses into society. Then what flows out of these full human beings can live in society rather than a new generation becoming a result of what existing society wants to make out of it. (4 August, 1919; p. 26; translation by C. Holdrege)

I cannot possibly unpack all that is implicit in these few sentences. How do we teach without imagining a finished product or clear-cut goal? How do we work with a potential neither realized as yet nor fully known? Here I will focus on high school education, although much of what I bring is relevant to learning more generally.

Who Are You?

As an educator, I believe that the fundamental question about the student becomes: Who are you? I am working with you on a daily basis and yet I don't know you. What

is it that you want to realize in your life? Neither I nor the student can answer these questions. If we could, it would mean there was no development. Everything would be clear. Through an ever-renewed effort to engage this questioning, searching attitude of mind and to work with the students out of it, something new and essential arises in the learning community. What happens is that the students become “large”; that is, I don’t just see them as adolescents now with their quirks, gifts, and difficulties, but as participants within a developmental stream of human life. Second, I acknowledge in the students a dimension of inner depth—a realm out of which their individual questions and strivings arise. This realm remains hidden for me if I get caught up in the outer trappings of adolescence. I know that in each student something wants to grow like the growing point of a plant—vulnerable, tender, and full of life. I don’t want to crush that! I’m dealing with a kind of “holy of holies” in each student that warrants deep respect. It needs protection, and it needs soul space and biographical time to develop.

In this attitude of mind I become a listener. Can I hear what it is that you are really asking—and listen through the pointed question or the cold logic with which you argue? I’m trying to hear the meaning or intent that arises out of the deeper, hidden source that speaks “between the lines” in word, gesture, and action. And inasmuch as I do hear something, my inner response is: how can I serve what you are saying through my work with you? This is, to state the relation differently, the attitude of teacher as a midwife, who helps give birth to that which wants to come into the world and thrive.

In my experience, students notice whether you are working out of such an attitude—which is not explicit but implicit in all the smaller and bigger interactions that occur. It provides a kind of fertile ground out of which manifold learning experiences arise.

I remember quite vividly an interaction with a student at the beginning of my teaching career. He asked a few questions and they were leading off topic—which can be fine. But then I noticed that there was more going on—he was trying to get me off topic. At that moment I abruptly shifted back to my chosen theme and we moved on. I reflected on this experience and realized that in a sense the student was testing me, and in so doing he was implicitly asking: Who are you? Do you know what you are doing? I never said a word about what had happened. After this class our relation shifted. He had been distant, displaying in class a fairly distinct attitude of disinterest and, on the surface, a look of: “Who are you to be teaching me?” In that class we had met each other below the surface—closer to the source—and from then on we could interact in more human ways.

The Curriculum—A Task Not a Thing

Every school has a curriculum. It usually consists of guidelines for what is to be taught in the different disciplines and grades. Unlike a walnut that falls on your head when you pass under a tree in the fall, the curriculum is not an act of God or Nature. It is something human beings create. In Waldorf education the curriculum goes back to lectures of Rudolf Steiner and to Steiner’s conversations with the teachers of the first Waldorf school. Before I started teaching in Germany I heard, for example, that in the ninth grade one (the ominous “one” who is both everyone and no one) teaches human biology with a focus on the senses, muscles, and skeleton. I was referred to Karl Stockmeyer’s book on the curriculum. Stockmeyer, a teacher in the first school, took on the monumental task of pulling together Rudolf Steiner’s remarks about what could be taught in the different grades and subjects.

To my surprise, I found only one quotation for the ninth grade in Stockmeyer, and no commentary. Steiner had said nothing about the senses, muscles, and skeleton in this grade. What he said was:

Continue the study of the human being so that the students receive a proper grounding in human biology [Anthropologie]. This should be done in concentric circles, expanding from class to class and the other sciences should be added. (September 22, 1920)

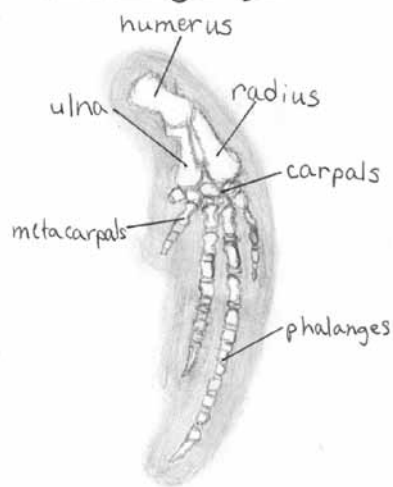
Steiner does mention teaching the senses, muscles, and skeleton in the eighth grade. And, in fact, many eighth grade teachers have done so and are doing so around the globe. I don’t know how or when the tradition began to teach these topics also in the ninth grade. Interestingly, this tradition has not taken hold in the United States, where another tradition has developed to teach internal organs and systems (circulation, nervous system, digestion, metabolism, etc.) in the ninth grade, a topic that is often covered in Germany in the tenth grade. And in the United States embryology is usually taught in the tenth grade, while in Germany it is taught in the eleventh grade. I have heard good arguments for both traditions.

I’m not interested here in whether one tradition is right or wrong, better or worse. The Waldorf curriculum is not a “given” that a teacher simply has to accept and implement. It is not some lasting edifice that stands on its own for as long as possible, to which perhaps we occasionally make additions or subtractions. It has developed—and needs to continue to develop to stay alive. In a living organism even the bones, the most architectural parts of our body, are continually being built up and broken down, and adapting

Hind Limb of the Chimpanzee



Forelimb (fin) of a whale



A ninth grade student's drawing

to new activities and to stresses and strains that life puts upon the body. They are permeated by life. I believe that we can view the curriculum as something alive that does not exist by itself but is being continually shaped and re-shaped out of the activity of all those involved in the educational process.

From the teacher's perspective the curriculum then becomes a search, a question, a matter of research. When, for example, we take the "indications" in the so-called curriculum and follow them back to their source in Steiner's lectures or the meetings with teachers, we begin to see them in their respective contexts. They cease being isolated instructions. Moreover, most of these suggestions are anything but straightforward. What might it mean to teach about the organs and their functions in relation to the soul and spirit in the tenth grade? What did Steiner mean by emphasizing "mutual causation" ("Wechselursachenverhältnis") in eleventh grade biology?

These and many more indications are challenges and questions, not contents to be implemented. We could also say: the curriculum points in a direction; it is food for

thought, and the essential thing is that we become active in crafting the curriculum out of our inner efforts, the work with the students, the conversations with colleagues, interactions with parents, and so on.

Engaged Learning

When, as a young teacher, we enter a school, we enter a particular context. We may well be told that in a particular class this or that subject matter is usually taught, and we can take that as our starting point. We can study Stockmeyer or newer books on the curriculum such as the one by Richter and Rawson (2000). We can go back to Steiner's writings and study them. We can talk with our colleagues and experienced teachers from other schools and ask what they teach. We can collect work from students who have been taught by different teachers. All this can provide orientation and help us on our way. It's the time of apprenticeship as a teacher.

But what is essential during this time is that the recommendations we receive from the outside are not simply taken up and implemented. We need to be inspired by what we teach. The inspiration comes when an idea or recommendation resonates with what each of us as a human being and educator feels to be important and essential. When

teachers feel compelled to teach something based on outer authority, the teaching can hardly be authentic and will bear little fruit.

Once a new teacher I was mentoring tried some of the things he knew I had done. He told me afterward that the classes weren't going well. I sensed that he was trying to imitate what I was doing, but wasn't really all that moved by it. When a next block was about to begin, I didn't tell him what I'd done. I said, "Teach something you are interested in and passionate about, that you feel the students might take interest in." He took up a content area that he knew well and that he found significant and interesting. He began teaching out of himself, and the content was permeated with his being. This is, I believe, what the students perceive and acknowledge. The classes went much better. The students were more involved and interested.

Of course being inspired about a topic is not enough. After a year or so of teaching I was asked to teach geology in the ninth grade. I said I would. I prepared, spent time in the Alps, scouted out areas nearer my school for field trips, and so on. After all this I had thought: this may

NATURE NOTES

I observed a small patch of toothwort in the woods on May 3 and May 11. At the first observation, this broad, low leafy plant had a thin stem topped with tightly closed buds. At second observation, only one bud was left, the others having opened into small, white four-petaled flowers.

MAY 3



MAY 11



Student notes and a sketch from a twelfth grade botany class

interest me, but it's not going to interest the students. I had a horrible feeling that the block would be at best a minor disaster. Luckily, I was able to arrange a conversation with Guenther Zickwolff, an experienced teacher. We sat together for an hour. He did not focus on what to teach, but described how he brought geology to life in the classroom. After that hour I knew what was missing in my preparation. Zickwolff had described riddle after riddle that geologists had faced when confronting the world of rocks, mountains, glaciers, etc.

I realized, for example, that my task was not to tell the students that rock layers have different ages. Rather, I could let them follow William Smith's wandering through

England examining rock layers, collecting and comparing fossils from different layers. What did it mean that some fossils were only in distinct layers and that he could find these "index fossils," as he called them, in various parts of England? How could we understand that the fossils resembled aquatic organisms? How might we think that the layers of fossil-containing rock came about? What might our musings lead us to think about the difference between upper and lower layers?

After trying to craft learning encounters in this way with the students, it became increasingly clear to me that they were learning to experience the world as a world to be explored rather than a set of facts to be learned, and also they were

participating in how living science unfolds. I tried to become more aware of and to avoid the teacher's tendency to provide de-contextualized answers to questions that the students never asked ("there are three fundamental types of rocks..."). We explored together, often guided by the work of great scientists who had explored before us and who show by example what it means to be a careful observer, to be persistent, to ask questions, to learn from mistakes, and to recognize relations that at first are not readily apparent.

The effort revolves around letting a process unfold in which the students can participate and take interest. And interest is strongly awakened through riddles, for when riddles arise in us, we become active and engaged in a search. We don't begin with answers to questions the students never had; we provide a context that leaves space and time for the students to explore, to formulate ideas themselves and to consider how their ideas relate to the phenomena. Riddles are an opening into the unknown future.

What's important is that we have entered a process of inquiry that does not stop as long as we teach and learn. We have left behind the curriculum as an authority that says: "this is what must be done." The individual in us needs to be active and striving, and questioning the courses we develop. In this effort (and it is the ongoing effort that matters) I meet as a developing, searching being the students as developing, searching beings. In other words, we meet as beings of activity, as beings therefore not limited by what is and has been; we are open to the potential we call future, a potential that as a source of life can work into the present at any moment.

The Presence of the Unknown

I often taught a botany block in the 12th grade near the end of the school year—right before the students were to present their individual year-long projects and before their stage play. In other words, not exactly an ideal situation for classroom learning. I developed the block as a field course and the plants themselves taught most of the content. We'd go outside nearly everyday and observe, describe, and identify wildflowers growing in the different environments around the school. By entering into a dialogue with the plants through their work, the students recognized that plants are quite remarkable creatures. And in observing many different plants they began to get a sense for different growth forms, flowering patterns, and the relations of specific species to specific environments.

In one class, toward the end of the block, we were sitting at the top of a wooded hill studying the wild columbine,



Wild columbine flower

a plant that grows on rock outcrops. It was hard not to be drawn to its remarkable hanging and highly structured scarlet-red and bright-yellow flowers. While the students were observing, writing, or drawing, one of them asked, "Mr. Holdrege, where do all these plants come from?" Out of the whole situation, it was clear to me that this was not a question to be answered. Every answer would have fallen flat in light of that which, for a moment, this student had inwardly touched. I think I just looked at her and nodded in the inner acknowledgment that I have the same unanswered question. This was a golden educational moment that I cherish to this day.

Something of the normally unmanifest and deep nature of plants had become present in this student's soul and her response to this meeting was wonder and a question. The experience of such a presence is not clearly outlined and definable because it is an opening into a reality that can still become, that has depth and potential. For this reason it is experienced as alive and vital; we touch a common source of becoming in ourselves and in the world.

Every time wonder arises in the encounter with the world; when questions spring up; when the students see riddles that ignite inner movement; when answers not only bring satisfaction but are an opening into even deeper questions; when the students are experiencing a teacher who is also searching and learning—in all these ways the unknown becomes present in education.

Education as Encounter

What I have been describing is education as personal encounter. For teachers, there is so much that we can bring the students into contact with. We have to be selective—especially since encounters don't just happen; they grow out of engagement and dwelling with things. So the question arises: what learning situations do I want to facilitate for the students – which processes do I want to help get started—so that I prepare the ground for encounters? What is worthwhile for the students to engage in and learn from? At the beginning of a block or course, I asked myself such questions. They helped me to think more about why and what I was doing and also to become more attentive to those times when I felt that encounters were actually taking place. Over time you can begin to develop a kind of sense organ for the quality of encounters. You can't make encounters happen, but you can become aware of them when they do happen and reflect on the processes that facilitate their happening.

The philosopher Albert Borgmann speaks of “reality” taken in the sense of genuineness, seriousness, or commanding presence, the sense we have in mind when we speak of real gold as opposed to things that merely glitter and of a real person, a mensch, as opposed to a dude” (1995, p. 38). He goes on to say:

What is eminently real has a commanding presence and a telling and strong continuity with its world.... Whatever engages our attention due to its own dignity does so in important part as an embodiment and disclosure of the world it has emerged from. (pp. 39-40)

There are many presences we can encounter: a biographical story, a rock formation, a plant, wood or stone in carving, a great novel, the images of a poem, serious conversation in the classroom, a camp fire, a myth, carrots waiting to be harvested, or questions of an inquiring scientist. All these “things” and many more are genuine presences that the students can meet. They all are rooted in larger contexts—they aren't glitter and surface, but have depths to reveal, each in its own way. Meeting them can let us glimpse or touch the deeper unknowns of the world and ourselves.

In such encounter-based learning, education becomes life. It is not a preparation only for what comes later in a linear sense. This is an insight and a practice that inspires: education is about real encounters! It can move us to review and assess our current practices so as to consider how much encounter-based learning is actually occurring. This, in turn, may lead us to seriously question some

forms and practices that schools have taken on. Might we need to strip school of some of its artificiality to make room for the dynamics and explorations that are needed to breathe more life into education? How might we de-school school so that we more adequately serve young people? What would we do if we could move beyond the mental pictures of “school” and beyond habits that limit our imaginations?

As with anything real, these questions cannot be addressed abstractly and generally. They need to be addressed concretely, on the ground, in ways possible and appropriate for groups of educators and students working in different cultures and countries.

Wherever in the world students are engaging in some form of exploratory, encounter-based learning, something important is happening. These young people are plunging into processes, experiencing challenges, grappling with difficulties, raising questions, and working with nascent insights. Through encounters with genuine presences they have experienced depths and meaning and becoming. They are not separate from these creative sources. We have reason to hope that the world will not be prepared for what they bring to it.

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