In Context

Number 15 Spring 2006

The Newsletter of **The Nature Institute**

#15

Dear Readers,

The articles in this issue of *In Context* continue to show how contextual, qualitative methods of scientific inquiry find application in many different fields. For example, in one of our feature articles a medical doctor, Philip Incao, looks at infectious and inflammatory illnesses in the larger context of the human being. He finds that, while the single-minded focus on microorganisms as the responsible agents in disease may give us a neat and satisfying sense of cause and effect, this way of thinking deeply misrepresents what actually happens when we get sick. The truth requires us to reckon, first of all, with the health or ill-health of the human organism as a whole.

In our Notes and Reviews section we offer two tantalizingly brief excerpts from books by the physicist, Georg Maier. He considers the various ways we have pictured the "flowing and spreading of light in space" historically, and then asks us to revise our pictures in a way consistent with the understanding physics has arrived at during the past century. This revision, as justified as it may be in light of the concepts of contemporary physics, may nevertheless come as a jolt not only to the layman but also to the scientist, owing to the heavy weight of long-established habits of thought.

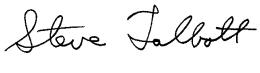
And then, in our second feature article, we hear from someone in the humanities. Professor of English, Christina Root, examines the character of conversation and discovers in it some of the essential traits of a contextual or Goethean scientific approach. Goethe himself—and, in particular, two of his important conversational encounters—serve as illustrative centerpieces in her essay.

Each of these articles may, in its own way, bring home to us a crucial awareness—namely, the awareness that awareness itself is central to a contextual science. That is, as knowers we are part of the context, and if we do not consciously attend to the potentials and limitations of our various ways of knowing, we will find ourselves (without recognizing it) trapped within the unexamined conditions of our own subjectivity. This may be true even if tradition has glorified our unexamined habits as "rigorous" and "objective."

Speaking of awareness: we have also thought it important in this issue to let you know about the special financial challenges we face this year. With foundation support leveling off and the Institute's work and budget growing, we now need support from individuals more than ever. For more information see page 12.

Craig Holdrege

Steve Talbott



The Nature Institute

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The Light of Sense Experience

Georg Maier

This article consists of excerpts from two books. The immediately following text is from Optik der Bilder *(1986) by physicist Georg Maier (excerpt translated by Henrike Holdrege and Steve Talbott). The second half of the article is taken from a new book entitled* Being on Earth: Practice in Tending the Appearances*, co-authored by Maier along with the late Stephen Edelglass (also a physicist) and the late Ronald Brady (a philosopher). The passage reproduced here is from a chapter written by Maier and entitled "Sense Perception as Individual Experience: Pursuing Georg Berkeley's Thoughts on Vision." See below for further information.*

THE DEVELOPMENT of natural science over these last centuries has brought an increasing distrust of sense perception. This is remarkable, since during this same time nature observation and experiment were exalted as the sole sources of experience. The apparent contradiction dissolves when we recognize what sort of reality the leading thinkers were willing to acknowledge. The program laid down by such pioneers of natural science as Descartes and Locke was guided by a particular criterion of reality: as essential properties of things they accepted only "primary" qualities—that is, position (locus), movement, spatial form—qualities readily yielding to mathematical treatment.

By contrast, the "secondary," inessential qualities included sound, taste, smell, and sensations of warmth, but also the qualities of sight such as brightness and darkness. Because of their "merely apparent" character, these qualities were understood as pointing toward underlying structures of the primary kind. This requires us to develop mental images relating the fleeting sense qualities to bodily (physical) processes.

The history of modern physics is closely connected to changing viewpoints about the nature of light. The mood of those earlier times can be felt in the way scientists struggled to interpret the "spreading out of light in space" in terms derived from the experience of one's own physical body. To illustrate this, here is a quotation from Descartes' treatise on *Optics* (1985, p. 153):

"No doubt you have had the experience of walking at night over rough ground without a light, and finding it necessary to use a stick in order to guide yourself. You may then have been able to notice that by means of this stick you could feel the various objects situated around you, and that you could even tell whether they were trees or stones or sand or water or grass or mud or any other such thing. It is true that this kind of sensation is somewhat confused and obscure in those who do not have long practice with it. But consider it in those born blind, who have made use of it all their lives: with them, you will find, it is so perfect and so exact that one might almost say that they see with their hands, or that their stick is the organ of some sixth sense given to them in place of sight. In order to draw a comparison from this, I would have you consider the light in bodies we call 'luminous' to be nothing other than a certain movement, or very rapid and lively action, which passes to our eyes through the medium of the air and other transparent bodies, just as the movement or resistance of the bodies encountered by a blind man passes to his hand by means of his stick. In the first place this will prevent you from finding it strange that this light can extend its rays instantaneously from the sun to us. For you know that the action by which we move one end of a stick must pass instantaneously to the other end, and that the action of light would have to pass from the heavens to the earth in the same way, even though the distance in this case is much greater than that between the ends of a stick. Nor will you find it strange that by means of this action we can see all sorts of colors. You may perhaps even be prepared to believe that in the bodies we call "colored" the colors are nothing other than the various ways in which the bodies receive light and reflect it against our eyes. You have only to consider that the differences a blind man notes between trees, rocks, water and similar things by means of his stick do not seem any less to him than the differences between red, yellow, green and all the other colors seem to us. And yet in all those bodies the differences are nothing other than the various ways of moving the stick or of resisting its movements. Hence you will have reason to conclude that there is no need to suppose that something material passes from objects to our eyes to make us see colors and light, or even that there is something in the objects which resembles the ideas or sensations that we have of them. In just the same way, when a blind man feels bodies, nothing has to issue from the bodies and pass along his stick to his hand; and the resistance or movement of the bodies, which is the

sole cause of the sensations he has of them, is nothing like the ideas he forms of them." (Descartes 1985)

By comparing the spreading-out of light to a stick transmitting shocks from one body to another, Descartes encouraged a line of thinking that would later be elaborated into the wave theory of light: light is the condition of movement of a medium. This was hard to imagine because light also spreads out in a vacuum—that is, in the void. So the void, or vacuum, had to be understood as the light's transparent medium.

In the history of physics this point of view contradicted another one, which held that light consists of minute balls that can fly through air, glass, and, best of all, empty space. Isaac Newton took this view. For him, different colors were particles of different kinds. In the nineteenth century the wave concept triumphed over the particle concept. In particular, Augustin Fresnel discovered new phenomena, which clearly had to be explained as the mutual canceling and amplifying of light waves. Moreover, electromagnetic (radio) waves were produced and showed the same phenomena. And so light came to be understood as electromagnetic oscillation, and the different colors as oscillations of different frequencies or (seen spatially) different wavelengths.

In the twentieth century, however, the concept of particles revived. In near darkness one could observe effects of light concentrated in single events—light quanta. Max Planck showed that the radiation of hot bodies could also be understood on the assumption that light is emitted in the form of quanta—quanta that occur on a certain random basis. Every twist in this barely sketched historical investigation was understood as a step in the discovery of light's true nature. Followers of the different theories fought with each other, because light must consist either of waves or particles.

One might now say, "Science has proven the particles to be 'light quanta'; therefore they travel around." However, anyone who studies the history of models in physics knows that the particles do not manifest themselves "along the way," but only if you disrupt the optical context you are investigating. If you try to determine the "route" of the particles by introducing a particle collector between a light source and an object it illuminates, you immediately create a new and different situation. Therefore the physicist does not say any longer, "Light consists of particles transported through space." Strictly speaking, nothing matter-like streams through space. Instead we find various contexts involving spatially separated loci, wherein causes at the one locus call for effects at the other locus....

Despite the twentieth-century development of quantum mechanics in physics, the mental image of a particle-stream remains deeply rooted today.... People say, "When a lamp illuminates a surface that is separated in space from the lamp, there must be a physical process in the space between —a process mediating between the cause (shining lamp) and effect (illumination of the surface)." And they are convinced that only through mental images of such processes can we understand the lawfulness of illumination and its causes.

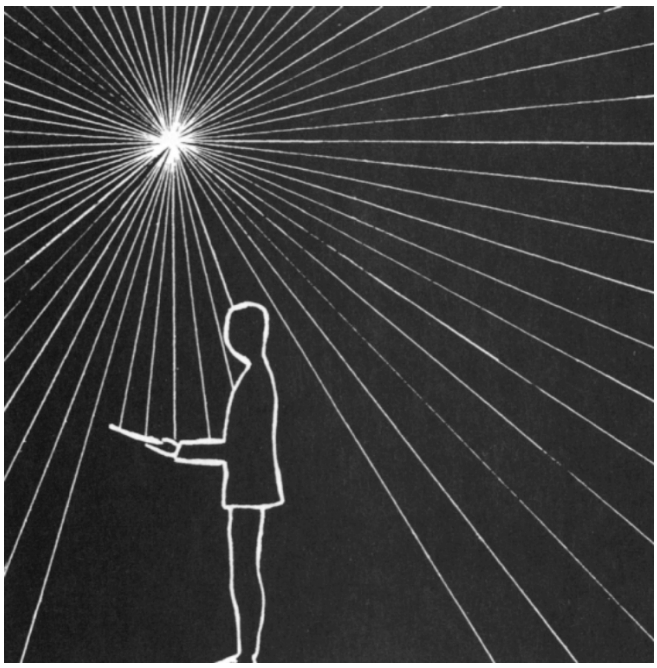
So the imagined processes are placed exactly where there is no visible phenomenon. The lamp is visible, and the surface illuminated by it is visible. Can we understand the relation between the two by renouncing mental images of the mediating physical processes we have invented?

* * * * *

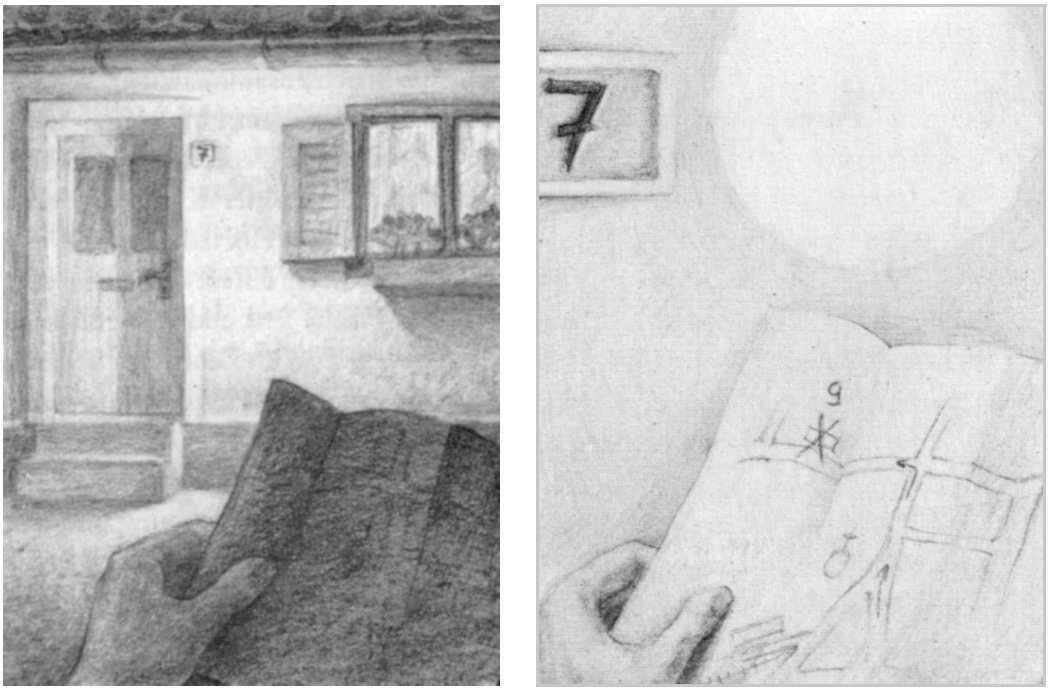
(From *Being on Earth:*)

The Law of Illumination

Although the moon is brightly illuminated by the sunshine, the sun's "light" that supposedly flows through space to be reflected by the moon is not itself a visible phenomenon! This means our Berkeleyan visual standpoint (Berkeley 1953) does not allow us to invoke such flowing light in our explanations. What we definitely do know is that sources of illumination are especially bright "things of sight," as Berkeley would say. And these must be visible from any surface they are illuminating. Putting this in other words, we may



In the usual explanation, illumination is understood to be caused by rays emanating from a source (often idealized as a point source) and spreading outward. The nearer an object is to the source, the more rays it intercepts and therefore the brighter it appears. (Illustration from Maier 1986.)



The outdoor lamp next to the house number "7" increases in apparent size as one approaches the house, and so does the illuminating effect of the lamp. (Illustration from Maier 1986.)

formulate the following principle: objects light up according to their visible surroundings. On these terms alone—and without reference to flowing light—we will be able to explain the diminishing brightness of illumination at increasing distance from a lamp.

Illumination is usually explained as follows. Imagine light to be steadily issuing from a lamp in all directions. We assume the surrounding space to be perfectly clear, so no light is lost as it spreads into space. But the light must *expand*, so that its power to illuminate is distributed over surfaces of greater extent at greater distances. Take the lamp to be located at the center of a sphere, with the flow of light distributing itself evenly over the surface of the sphere. The area of this surface grows in proportion to the square of the sphere's radius. Thus, as distance from the lamp *increases,* the illuminating effect of the lamp *diminishes*, corresponding to the reciprocal of the square of the distance.

This argument depends on our imagining ourselves to be observing light as it crosses space in front of us, as if its movement could be seen from the side. We are all used to imagining this. But if we remind ourselves of the appearance of the moon at night—where we do not see sunlight streaming toward it—we will have to admit that this habit is not supported by experience. Berkeley did not like it. But it has hardly been noticed that his approach — which is meant to rest on sense experience—leads to an alternative train of thought that is just as useful in its result. Doing without the imagined viewer observing a stream of light from the side, we can deal with the problem of illumination this way:

We take lamps to be "objects of sight." That is, they gain in visible size as we move toward them and diminish in visible size as we move away from them. This is the effect of perspective. And as we will see, this change in visible size is sufficient to give us the law we are seeking. Let us again assume that the atmosphere is perfectly clear. Then we can convince ourselves that the seen brightness of a lamp does not change with distance. That is: if we view two identical frosted lamps with the second one at a greater distance than the first, and if we allow the first one to overlap our view of the second, then we will readily observe that they appear *equally* bright. The two bright discs will *merge.*

What changes with distance is not the brightness, but the visible area of the lamp exhibiting this brightness. The *visible area* alone determines the illuminating effect at a given distance from the lamp. (Of course, inside science one does not say "visible area"; one speaks of the "solid angle" subtended by a luminous surface.) According to the laws of perspective, the visible area of a lamp will diminish according to the inverse square of its distance from the observer. So we have gained the same result we did above—but by speaking of the visible area of the light source rather than invisible rays moving through space. Outside the immediate vicinity of the lamp we get exactly the same simple law as above. And since we have given up the usual idealization which treats the lamp as a point source, our formulation of the law now deals with the problem of illumination in the immediate vicinity of the lamp—a problem that the point-source idealization cannot handle, namely, the fact that the illumination remains proportional to visible size. (The hypothetical "point source" from which the light is supposed to stream out into space is not given in reality—it would be physically impossible and, moreover, the calculated illuminating effect of such a point at close range would not be what we actually observe. On the other hand, the lamp that is more realistically taken to be of the nature of "things of sight" just grows in solid angle the nearer you approach it, consistent with the observed law of illumination.)

Note that by relating the apparent size of the lamp, *its visual quantity,* to its effect as an illuminant, we no longer need to assume that light transports itself through space, at least in the context of problems of illumination. But even in a much wider context modern physics tends to give up the notion of light traveling through space in the way bodies do. For example, we learn from principles of optical imaging that the precision of the image deteriorates as the line of sight (that is, the presumed path of "flowing" light) from object to image is defined more exactly. This can easily be demonstrated. Reduce the aperture of the eye's lens by looking through a tiny hole pricked into a piece of paper. In this way you define the sight path (the imagined "path of light") with greater precision. But the result is a blurring of your sight. The image deteriorates while your knowledge of the path between it and your eye becomes more accurate. On the other hand, the big telescopes used in astronomy, with their huge openings pointed into the sky, "see" an ever so finely structured scene. This reciprocal relation between precision of the line of sight and quality of the resulting image suggests that the supposedly *intrinsic*, ray-like character of light is really an *artifact* of the mind, an artifact that has been handed down from generation to generation.

* * * * *

Georg Maier's Optik der Bilder *is currently being translated into English for publication, perhaps in two years, by Adonis Press. The forthcoming Maier/Edelglass/Brady book,* Being on Earth: Practice in Tending the Appearances*, is now being readied for publication on The Nature Institute's website (http://natureinstitute.org). The book is an attempt to show (as stated in its introduction) that "a truly phenomena-based science has radical implications for understanding sense experience and the world of phenomena."*

After taking his Ph.D. in physics in 1960, Georg Maier spent about seven years doing nuclear reactor-based research, particularly in the field of neutron optics. From 1969 to 1998 he worked at the Research Institute of the Goetheanum in Dornach, Switzerland, pursuing investigations in many fields of physics and publishing numerous papers. Now retired, he continues his researches in Dornach, where he lives.

Georg's life-long physical investigations have been gaining a living presence at The Nature Institute, particularly through Henrike's work in optics. For example, her seminar on "Seeing with Fresh Eyes: Phenomenological Exploration of the Visual World" (part of this spring's Goethean Science course) is substantially founded on Georg's work.

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Maier, Georg, Ronald Brady, and Stephen Edelglass (forthcoming). *Being on Earth: Practice in Tending the Appearances.* This book will soon appear on The Nature Institute's web site.

Will Biotech Feed the Hungry?

Looking Closer to Home / A Commentary

Craig Holdrege

On our planet with nearly six billion people, 840 million are undernourished. Proponents of modern industrial agriculture believe genetically engineered crops hold the promise of a new green revolution, a revolution that will bring higher yields and nutritionally enhanced crops to developing (third-world) countries.

The United Nations Food and Agriculture Organization (FAO) issued a report in 2004 describing how biotechnology can "help significantly in meeting the food and livelihood needs of a growing population." Since the FAO is known for its multifaceted efforts to empower small poor farmers in the third world, this endorsement of agricultural biotechnology, which is currently driven by a few giant multinational companies, came as a surprise to many.

It also generated a wave of opposition. An open letter to the FAO's director, Jacques Diouf, signed by many third world farmers and civil society organizations, derides the report as highly biased and as fodder for the biotech industry's PR machine.

The main question is: how closely coupled are hunger and agricultural production? Let's not speculate. Let's look at some facts here in the United States, which grows more genetically engineered crops (mainly soybeans, corn, and cotton) than any other country—120 million acres in 2005.

According to a U.S. Department of Agriculture study, in 2004 13.5 million American households (home to 35 million people) did not always have an adequate supply of food. In 4.4 million of these households, the situation was bad enough for the study to speak of "food insecurity with hunger."

These are astoundingly high numbers for the largest food-producing country on the planet. In 2003, the U.S. exported 93 million metric tons of wheat, corn, and soybeans. Evidently, the copious amount of food produced had very little effect on whether people went hungry. Seventy percent of the grain harvested in the U.S. is fed to cattle, pigs, and poultry.

In the U.S.—as elsewhere—hunger and food insecurity are related to a lack of money to buy food. Over half of the food-insecure American households receive some form of assistance through food stamps, free school lunches, and food pantries. Without this—albeit inadequate—safety net, which is funded largely by the federal government, the extent of hunger in the United States would be much greater.

As one might expect, the most needy people are those with incomes below the poverty line (in 2005 set at $19,350 per year for a family of four), as well as households with children (especially single-parent households), and minorities (African-Americans and Hispanics). The problem of hunger in the United States is an extremely complex issue of poverty, discrimination, and social and economic policies and practices.

The boom in biotech crops since the late 1990s has done absolutely nothing to address these issues. Since 1999 there has been a yearly rise in the number of food-insecure households, and in 2004 2.5 million more families than in 1999 did not have enough food.

The situation is considerably worse in developing countries. Although both China and India have become essentially self-sufficient in food production over the past decades, have grain reserves and even export food, 140 million people in China and 250 million people in India are malnourished. Even if biotechnology could contribute to a sustainable increase of food production in developing countries—which is questionable—that would by no means guarantee that the people who need food most would actually receive it. Poverty, inequality, and inadequate food distribution present the greatest great hurdles to feeding the hungry.

Isn't it irresponsible hype to claim that biotech crops will address the issue of hunger in poorer countries when widespread application of GM-crops in a rich country like the U.S., with its well-honed economic and transport infrastructures, has not provided food to millions of its inadequately fed citizens? One thing is clear: increasing food production alone does not mean fewer people will go hungry.

This commentary is taken in part from an in depth article on the issue of biotech agriculture, world hunger, and sustainability by Craig Holdrege, which is posted on our website: http://www.natureinstitute.org/txt/ch/feed_the_world.htm

Open House at The Nature Institute

On Thursday, June 15, we will host a festive evening celebrating the accomplishments of students in our Goethean Science Studies course. Included in the evening will be a display of projects completed by the students. Mark your calendars for 6:00 – 8:00 p.m. on this date.

Publications in the Works

If you've noticed a particularly intense, preoccupied look on our faces lately, it's because we've been dealing with an unusual conjunction of schedule and deadline pressures on major publication projects. The major items:

** Craig Holdrege's and Steve Talbott's previously published essays on genetics, biotechnology, and agriculture, along with material still to be written, are being gathered into a book under contract to the University Press of Kentucky. The book will be part of a UPK series entitled "Culture of the Land." The series is intended to explore a new agrarianism that "considers the health of habitats and human communities together":

> Agrarianism is a comprehensive worldview that, unlike other forms of environmentalism that often presuppose an antagonistic or exclusive relation between wilderness and civilization, appreciates the intimate and practical connections that exist between humans and the earth. It stands as our most promising alternative to the unsustainable and destructive ways of current global, consumer culture.

One of the Press' reviewers wrote of our preliminary manuscript, "I have been covering agricultural biotechnology since 1997 and believe that their analysis of genetic engineering is the smartest, most original, and most compelling I have seen anywhere, in journalism or academia." Another wrote:

> This book should command wide public attention (all reporters covering genetic research should be tarred and beaten if they do not read it!) and would readily have great appeal as a textbook in courses covering genetic research, biotechnology, genetic engineering, and the philosophy of science. The language is precise without being technical. It is always informative and provocative in the questions it asks.... In sum my evaluation is entirely positive. If you can squeeze more out of these writers I would recommend it.

The impressive advisory board for the series includes Wendell Berry, Wes Jackson, Vandana Shiva, Bill McKibben, and Michael Pollan.

** Steve has been preparing a collection of his writings for publication as a book by O'Reilly Media, a major publisher of technical books in the computer field, but also of trade (general-interest) books. The book, tentatively entitled *Virtuous Machinations: On Conversing with Our Machines*, includes many of Steve's essays from The Nature Institute's online *NetFuture* newsletter. Some of these essays were published in two of the booklets in our Nature Institute Perspectives series; those booklets will constitute two of the five sections of the new book. O'Reilly is hoping for a Fall, 2006 release of the book— if only Steve can manage the preparation of the text in time. *(continued on p. 10)*

In November, 2005, the Institute celebrated its first seven years. Eighty people from the local community attended the festive event, which included music, a talk on the bison, a display about the work of The Nature Institute, and plenty of time for conversation around the refreshment tables.

Our 2006 Spring Program

This spring we have a rich program of lectures and workshops. The lectures and workshops are part of our 11-week Goethean Science Studies course and are open to the public. We are fortunate to have such a capable and diverse array of presenters in the program. See below for information about the speakers.

Dynamic Patterns in Nature: The Example of Dinosaurs

A workshop with Martin Lockley

April 20-21, Thursday, 3:00 to 4:30 p.m. and Friday, 10:45 a.m. to 3:30 p.m.

Tracking Dinosaurs Around the World

A lecture by Martin Lockley

April 21, Friday, 7:30 p.m.

Opening the Gates of Knowledge: Beyond Modernism and Postmodernism

A seminar with six sessions with Douglas Sloan

April 25, 27, May 2, 4, 9, and 16, Tuesdays and Thursdays, 10:45 a.m. to 12:15 p.m.

Spiritual Perspectives on the Rise of Technology

A lecture by Arthur Zajonc

May 10, Wednesday, 7:30 p.m.

Goethean Science and Modern Physics

A workshop with Arthur Zajonc—*please pre-register*

May 11, Thursday, 8:30 a.m. to 3:30 p.m.

What Owen Barfield Thought

A lecture by Gertrude Reif Hughes

May 24, Wednesday, 7:30 p.m.

Poetry as a Schooling of Perception

A workshop with Gertrude Reif Hughes

please pre-register

May 25, Thursday, 8:30 a.m. to 3:30 p.m.

Images of Water: Probing the Essence of Water's Nature

A lecture by Michael D'Aleo

June 1, Thursday, 7:30 p.m.

Water as Activity: Moving Beyond a Material Conception

A workshop with Michael D'Aleo

please pre-register

June 1-2, Thursday 3:00 to 4:30 p.m. and Friday 8:30 a.m. to 3:30 p.m.

Open House

June 15, Thursday, 6:00 to 8:00 p.m.

About Our Spring Program Presenters:

Michael D'Aleo teaches high school physics at the Waldorf School of Saratoga Springs. He is also co-director of foundation studies at Sunbridge College and founding member of Saratoga Experiential Natural Science Research Institute.

Gertrude Reif Hughes is professor of English and Women's Studies at Wesleyan University in Connecticut.

Martin Lockley is professor of paleontology and director of the Dinosaur Tracks Museum of the University of Colorado at Denver. He is an internationally acclaimed authority on fossil footprints.

Douglas Sloan is professor emeritus of education and history of religion at Columbia University.

Arthur Zajonc is professor of physics at Amherst College and lectures widely on the theme of science and spirituality.

** Craig and Steve have also been working on an article under contract to *Orion* magazine. Currently entitled "The Forbidden Question: How Geneticists and Other Technicians Give Us a Faceless World," the essay will appear in the July/August, 2006 issue. In it the authors raise a widely ignored but decisive question that presents itself, or ought to present itself, whenever we confront another one of earth's creatures: "Who, if anyone—what sort of being—is there?"

Of course, Craig's whole-organism studies are intended to answer exactly this question—not so much in a philosophical manner, but by actually sketching the character of the distinctive way of being of particular organisms so that any one willing to look in the right way can recognize who is there. The task is, in a way, much more difficult when you have to try to *explain* the importance of that "way of being" without providing the extensive portraits that illustrate it and bring it alive. Trying to do this, however, is at least a good exercise for *us*!

** Also on the publication front, Steve's essay, "Toward an Ecological Conversation," is being included in a book arising from a conference he attended a couple of years ago at The Land Institute. The essay, which has perhaps attracted more attention than any other short piece Steve has written, originally appeared in our *NetFuture* newsletter and is also part of booklet #3 in our Nature Institute Perspective series. You can read it at http://natureinstitute.org/pub/persp/3/beast.htm.

Full-time Course in Goethean Science

As you read these lines, our Goethean Science Studies course is under way. The eleven-week course, which began on April 2, will end with an open house in mid-June. As we write these lines three days before the start of the course, the ice has disappeared from nearby ponds, and the spring peepers and tree frogs have just last night begun their chorus. Although crocuses are in bloom, the wildflowers here in Hawthorne Valley have not yet made their appearance. Our course participants will have the opportunity to observe spring's early stirrings and to follow them through to the unfoldings of summer.

The rhythms of the plant world gave us our primary incentive for scheduling the course at this time of year. Happily, despite the difficulty of the timing for teachers and many other potential students, enrollment has exceeded our minimum requirement.

After completing the renovation of our library last year, we now have all the books catalogued and ordered by subject and author. Come in and browse our collection of books on botany, zoology, genetics, natural history, philosophy, and other topics.

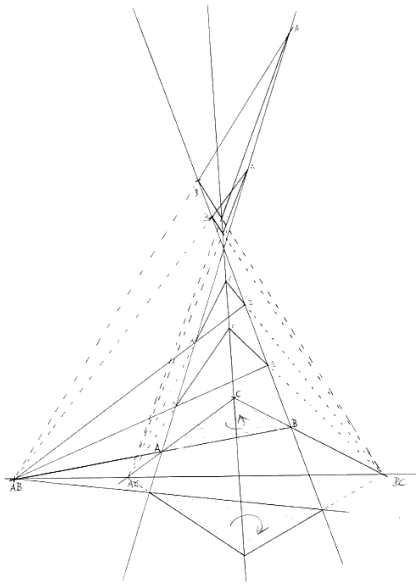
See the accompanying announcement of our spring program for information about guest teacher presentations that are open to the public. The core seminars are being taught by Craig and Henrike Holdrege, with Henrike handling projective geometry and ("as a student of Georg Maier," she likes to say) phenomenological optics. Craig is teaching botany and also mentoring the students as they pursue their special projects relating to plants and plant habitats.

The two fields in which Goethe made his most substantial scientific contributions were plant metamorphosis and color theory. As a colorful spring unfolds here in Hawthorne Valley, students will have ample opportunity to follow in Goethe's footsteps, bringing his method to their own work in the diverse professions from which they come: creative writing, nursing, agriculture, landscaping, design, middle school teaching, and biology.

Projective Geometry

Since the spring of 2002, when The Nature Institute moved into its home on May Hill Road and five adults engaged in Goethean science studies with Craig over a period of three months, projective geometry has become an integral part of science training at the Institute.

Why? First, there is Henrike, who as a mathematician continues to study projective geometry and who loves to teach it. Second, projective geometry provides an excellent



training of thought and countless opportunities to observe one's own thought processes. Of course, mathematics has already given us a superb means for grasping the world quantitatively, but it can do much more for us than this. Just as we develop observational skills through journaling, drawing, and exercises of the imagination, so also we can work on our powers of flexible thinking through the unique character of projective geometry.

In our summer courses here at the Institute we have found that beginning every day with exercises in geometry awakened us and then supported in a profound way our work with the plant world. In this spring's eleven-week Goethean Science Studies course, projective geometry is taught twice a week.

For two and a half years Henrike has also offered ongoing courses in projective geometry at the Institute. One result of these courses is a small group of three women who trained this winter in order to teach projective geometry themselves—in a Camphill community, at Vermont College, and as part of science workshops. The series of concentrated, one-day training sessions in mathematics was, for all four women (Henrike included) most refreshing and delightful. In fact, for many of our students over the past several years, this discovery of delight in mathematics has come as the most unexpected and welcome surprise of their studies!

Transitions

We are pleased to welcome **Jeffrey Sexton** as our newest board member. He has a background in Social Therapy, having been a founder of the Lukas community in Temple, New Hampshire, and later a co-worker at Camphill Village, Copake, New York. Both these communities serve the needs of the developmentally handicapped. Jeffrey studied Waldorf education at Emerson College, Forest Row, Sussex, England, and theology at the Priest Training of the Christian Community, Stuttgart, Germany. He is currently president of the Hawthorn Foundation for the Healing Arts, which supports research development, education, and applications in holistic medicine, counseling, and a wide range of complementary healing therapies.

Also, after two and a half years as Outreach Coordinator for The Nature Institute, **Ann Elizabeth Barnes** has left in order to pursue more intensely some work she has long been involved in. She will play an active role in developing the Ashley House in Sheffield, Massachusetts, into a site on the newly developed Upper Housatonic Valley African-American Heritage Trail. The Ashley House is the oldest house in Berkshire County and was the home of Elizabeth "Mumbet" Freeman, an enslaved African woman who successfully sued for her freedom in 1781, thereby setting the stage for the abolition of slavery in Massachusetts in 1783. Ann-Elizabeth is also administrator of the Complementary Therapies Cancer Care at the Berkshire Taconic Community Foundation. Our warmest good wishes go with her as she engages in this work.

Luke Tekverk at The Nature Institute pressing specimens from his experiments comparing different genetic varieties of the mustard *Brassica rapa*. Luke is a senior at Hawthorne Valley School, and Craig Holdrege mentored him in his senior project.

Nature Institute Needs – What Your Donations Support in 2006

"*The interest of many focused on a single result can produce excellent results.*" (Goethe)

In all our work at The Nature Institute we aim to stimulate a transformation in the way people view and interact with nature:

* to become more aware of the biases that color our concepts, judgments, and experiences;
* to find new and vital ways of thinking and perceiving that can help us learn to interact with nature in healthier, more sustainable ways.

We approach this task in a variety of ways, which find expression in our research, publications, and education programs. At the present time the Institute has a staff of four and our 2006 expense budget is $295,000. This year we need to raise $100,000 beyond what we estimate we will receive from foundation grants, donations from individuals based on past giving, and program income.

Here are our major projects in 2006 that your donations this year will help us carry out:

Genetics, Biotechnology, and the Integrity of Life

* Life Beyond Genes: A Book on Genetics and Genetic Engineering. The University Press of Kentucky has asked Craig Holdrege and Steve Talbott to write this book, which will provide fresh and compelling perspectives on new developments in genetics and biotechnology. (See also page 8.)
* The Unintended Consequences of Genetic Manipulations. To raise awareness about the problems and dangers of genetic engineering, we want to begin in 2006 a two-year project to create an easily accessible, in-depth resource of information on our website about the unintended consequences of genetic manipulations.

Reconnecting Science with Experience: New Resources

* Experience-based Science Teaching. We plan to translate articles by Martin Wagenschein on science and science teaching and create a Wagenschein page on our website to help make his original and penetrating work available to educators and scientists in the English-speaking world.
* Being On Earth: Science Grounded in Perception. In collaboration with SENSRI, we plan to publish on our website a book on phenomena-based science and physics. The book, *Being On Earth: Practice in Tending the Appearances*, is co-authored by Georg Maier, Ron Brady, and Stephen Edelglass.

Adult Education: Courses, Workshops, and Mentoring in the Goethean Approach to Science

The Nature Institute is one of the few places in the world where people can go to learn about and practice the Goethean approach to science. Our educational offerings this year include:

* Goethean Science Studies. For the first time we offer this spring an eleven-week immersion course in the Goethean approach to science. (See page 10.)
* Coming Alive to Nature. Our weeklong summer course. (See page 23)
* Projective Geometry and Flexible Thinking. Henrike Holdrege gives courses for the public and mentors educators.
* Spring and Fall Programs. We will offer workshops and talks for the public.
* Guided Studies in Goethean Science. Craig Holdrege mentors individuals in individualized guided study programs.

Our Ongoing Publications: *In Context* and *NetFuture*

* *In Context* (two issues per year) contains feature articles, reviews, and news from the Institute on. It is presently sent to 2,000 individuals and organizations in 47 states and 26 foreign countries.
* *NetFuture: Technology and Human Responsibility* is our online publication. Steve Talbott places current technological and scientific issues in the broader context of human life and explores the foundations of a science of qualities. Currently it has over 3,500 direct subscribers and an estimated 3,000 to 5,000 additional readers via listserves and website (www.netfuture.org). After a hiatus due to book projects (see page 8), *NetFuture* will resume publication in summer 2006 with four to six issues per year.

Your donations will help make this work happen!

Thank You!

We are grateful to all of you who have contributed money, services, or goods to The Nature Institute (or to its publication, *NetFuture)* between October, 2005, and the end of March, 2006.

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Understanding Infection

Not a Battle, But a Housecleaning

Philip Incao, M.D.

I once saw a young African man in my practice who impressed me with his calm dignity and his radiant good health. I asked him what his parents had done when, as a child, he had come down with a fever. He replied that they had wrapped him in blankets to get him sweating. "Did they ever take your temperature?" I asked. He laughed and shook his head. "No, it was different from what is done here."

We often hear that American medicine is the most advanced in the world. This is true in some areas of healthcare, but in other areas we could use a little of the deeply rooted wisdom that still informs some of the folk medicine in the developing world. I think this particularly applies to our modern concept and treatment of the illnesses we commonly call "infections."

When we come down with a cold or a flu, most of us imagine that some stress or other has weakened our "defenses" or our "resistance" and allowed "a bug" (a virus or bacterium) to enter our body, where it multiplies and attacks us from within. We think that we are "infected," that the new bug within us is making us sick, and that we will feel better as soon as our immune system has killed it off. When we don't feel better soon enough, we might seek remedies or antibiotics to kill the bug more effectively.

Yet this commonly held picture does not correspond to the facts. It is a deceptive misunderstanding that in itself is a characteristic sign of the simplistic, weakened, and fear-based thinking that hinders progress in many areas of life today. If we define infection as the presence within us of foreign microorganisms, that is, bacteria and viruses, then all of us are continually infected from the day we are born until we die. We all harbor trillions of microbes all the time, including various disease germs, yet we only occasionally get sick.

Opportunistic Microbes

It may be a shock to learn that for over one hundred years the evidence has shown that our immune system does *not* prevent us from becoming infected by germs. In the early years of Pasteur's germ theory in the nineteenth century, it was first assumed that healthy people were uninfected by bacteria and only sick people were infected. This assumption was soon disproven, as science found that the great majority of those infected with disease germs were healthy, and only a small fraction of them ever got sick. The majority of people infected with the bacterium of TB, for example, never got sick from tuberculosis, but only from the same coughs and colds that we all get (Dubos 1958).

Infection alone is not enough to make us come down with a manifest illness. Something else is needed. Most of the time we are able to live in harmony with certain numbers of disease germs in our body without becoming ill. For this blessing we can thank our immune system, which is continually vigilant and active below the surface of our awareness in keeping the extremely varied and extensive germ population of our body under control. So it is not necessarily the entrance of new germs into our body that makes us ill; it is the sudden and excessive multiplication of certain germs that have already been in us for a longer or briefer time. In some cases the entrance of a new germ into the body is quickly followed by its rapid proliferation and in other cases the germ can remain dormant or latent in us for many years or even a lifetime while we remain healthy.

This important fact receives far too little attention and is often totally forgotten in medicine today. Most of the trillions of germs that "infect" or inhabit our body from infancy onward are peacefully co-existing in us or even helping to maintain our inner ecological balance, like the acidophilus bacteria that live in our intestines. They are our normal microbial flora. Science has also identified a small minority of germs, called pathogens, that participate in human disease, like strep, staph, TB, diphtheria, and so on. But these, too, have surprisingly more often been found peacefully coexisting in us rather than being involved in illnesses.

This is called latent or dormant infection, or simply the carrier state. Typhoid Mary was a famous example in the early 1900s of a cook who, though healthy herself, was a carrier of the salmonella bacterium and passed it on to others, some of whom became seriously ill and many others of whom remained healthy despite being infected. As the prominent microbiologist Rene Dubos stated in a 1950s textbook,

> …the carrier state is not a rare immunologic freak. In reality, *infection without disease is the rule rather than the*

exception….The pathogenic [germs] characteristic of a community do commonly become established in the tissues of a very large percentage of normal persons and yet cause clinical disease only in a very small percentage of them. (Dubos 1958, pp. 21-22. Emphasis mine.)

This leads us to the question that Rene Dubos, apparently alone among his colleagues, pondered for the rest of his life: if most of the time we are able to peacefully coexist with a disease germ in our body (a fact Pasteur did not adequately reckon with), what happens when it suddenly starts multiplying rapidly and we get sick? Have our defenses weakened and allowed the germs to proliferate and go on the attack (which is the thought that frightens us so terribly), or are they merely multiplying because our body's biochemistry has been disturbed and is making available to the germs a suddenly increased supply of their preferred nourishment?

The latter is not a new thought; it was postulated by Pasteur's contemporaries. Claude Bernard, Rudolf Virchow, Rudolf Steiner, and Max Pettenkofer held the conviction that the decisive and determining factor in infectious diseases was not the microbe itself but rather the particular condition of the patient's "host terrain" that favored the growth of a particular microbe. In this view, microbes were not predators but were scavengers feeding on toxic substances produced by imbalance, disease, and decay in the host body's terrain, just as flies feed on dung and garbage. For these scientists, killing microbes without improving the imbalances that fed the microbes was like killing flies in a messy, untidy kitchen without cleaning up the kitchen. Pettenkofer even drank a test tube of virulent cholera bacteria to prove his point that they would do no harm if the inner terrain was healthy. Pettenkofer's terrain apparently was healthy because he suffered no ill effects at all from his bacterial brew. Nevertheless, the germ theory was an idea whose time had arrived, and for many reasons the concept of germs as vicious predators soon prevailed over the view that they were opportunistic scavengers.

Action and Reaction

The consequences of the germs-as-predators idea are millions of unnecessary prescriptions written for antibiotics, and thousands of injuries and deaths from drug reactions, including 450 deaths per year from Tylenol alone (Wolfe 2002). The engine driving this inappropriate and dangerous use of antibiotics and anti-inflammatory drugs is the fear generated by our common misconception that we are under attack by predatory microbes whenever we experience fever, pain, congestion and other symptoms of typical acute inflammations such as coughs, colds, flu, or sore throats.

Another misconception is that the symptoms of an acute infectious-inflammatory illness like scarlet fever, polio, smallpox or flu are caused by the viciousness, the virulence, of the bacteria or the viruses which we imagine are attacking the cells and tissues of our body. The sicker we are, that is, the more intense our symptoms, the more vicious we assume the attacking viruses and bacteria to be.

In over thirty years of practicing medicine, I've found that this assumption, shared by almost all physicians and their patients, provokes more unreasoning fear and unnecessary use of drugs than any other.

The confusion stems from the fact that in an acute infectious-inflammatory illness we are experiencing not one happening but two polar opposite happenings that occur together. The first happening is that bacteria or viruses proliferate in our body. If these microbes were predators, we would expect their proliferation to coincide with the worst of our symptoms, but this is not the case. Most of the germ proliferation, which we falsely imagine as an inner attack, happens during the incubation period of the illness when we have few or no symptoms. Viruses and bacteria may enter our blood stream in large numbers, and may even start to leave our body, excreted in mucus and feces, without any awareness of illness on our part beside possible minor malaise, headache or tiredness. These symptoms might appear at the end of the incubation period during the few days of prelude or "prodrome" just before the full-blown illness begins. When the incubation period is over, the second phase of the process begins: the clinical illness comes on with all its strong symptoms of fever, pain, weakness, irritation, and often anxiety, and it may feel as if we are being attacked. In reality, the inner process causing our symptoms is neither an attack nor a battle, but an intense housecleaning.

These two two phases of illness are related to each other as a *reaction* is related to an *action*. Comparing illness to a housecleaning, the action is the gradual, mostly unnoticed accumulation of dirt and dust (along with the tiny creatures who make their home in dirt and dust) in the house, and the reaction occurs when the housekeeper can no longer tolerate the dirt and disorder and suddenly decides to turn the house upside down in order to clean it from top to bottom. In a house, as in the human body, the necessary housecleaning is a much bigger disturbance to the comfortable routine of the household than the accumulation of dirt and dust.

A Good Cleaning Out

Our immune system is the housekeeper of our body. Usually it keeps well abreast of its work, quietly escorting

dead and dying cells to the exits of our body and making sure that waste matter and poisons are cleared out. From birth until death, this ongoing maintenance work never ceases, and is responsible for keeping us healthy and free of illness. But when on occasion our immune system determines that a deep housecleaning is needed, that's when the dust flies and we get sick! If you are wondering where the germs are in this comparison of the human body to a household, they are the flies, ants, cockroaches, or mice that live in the house's inner recesses, unreached by the housekeeper and living on the accumulating crumbs and kitchen scraps.

The function of the immune system in this context is to create inflammation. Inflammation, as the word implies, is like a fire in the body, burning up the waste and debris, along with the germs that feed on waste and debris, and cleansing the body. So it is our immune system that causes us to become sick, by creating inflammation to drive out infection and renew us.

The accumulation of cellular waste materials and toxic by-products of our body's biochemical metabolic processes may go on for hours or years unnoticed by us because the body has various ways it can store toxic substances to keep them from irritating and poisoning us. We are postulating that various stressors, such as chilling, extreme exertion, or emotional stress cause a weakening or a breach in our storage processes that allows the toxins to escape from their storage sites in the body. Bacteria are attracted to, and feed on, these newly liberated toxins and begin to proliferate. The multiplying germs then provoke our inner housekeeper, the immune system, to action, and that's when we noticeably come down with the illness. And so, when we fall ill following an acute stress of some kind, it is because our inner balance was upset and our safely stored toxins were spilled. The spillage of toxins may also be triggered by the stress of our exposure to an ill person to whose acute infectious-inflammatory illness we are open and unguarded.

Thus we "catch" the illness and enter the incubation period when bacteria or viruses rapidly proliferate without producing major symptoms. The incubation period differs according to whether the illness is bacterial or viral. In a bacterial illness specific types of bacteria are attracted to the particular types of toxins released from storage and made available to them during the incubation period. In a viral illness the viruses themselves are a special form of toxic waste product which cells release when they are provoked by stress (as in an outbreak of herpes or shingles) or by "catching" an illness from another person.

When symptoms do set in, their intensity is a direct expression of the intensity of the reaction of our immune system. If I am correct in asserting that an acute infectious-inflammatory illness is really an intense housecleaning and not a battle against predatory invaders, then people with stronger immune systems and thus stronger housecleanings would be expected to have more intense acute inflammatory symptoms and stronger discharges than those with weaker immune systems. By inflammatory symptoms I mean pain, redness, swelling and fever followed by a good discharge of mucus, pus, rash or diarrhea.

In my medical practice I have repeatedly found that the stronger and more robust children become ill more intensely and acutely (with good outcomes nevertheless) than the weaker, pale and allergic children. I remember well one boy in my practice whose mother often brought him to the office because he felt unwell and weak. Usually in children who complain of feeling sick, one can find some evidence of an inflammation in the body, a red throat, a red ear, congested lungs or sinuses, some degree of fever, swollen glands, etc. In this boy I could find nothing. There were no signs of inflammation and no symptoms other than subjective fatigue and feeling unwell. Blood tests revealed a familial immune system deficiency.

This case brought home to me the fact that a weak immune system has difficulty reacting to a gradually accumulating infection of uncleared cellular waste and microbes. *Without a strong reaction of the immune system*, *there is no acute illness*, but only a vague malaise and fatigue, which are symptoms of a low-grade poisoning or toxicity in the body. When I would see this boy with the immune system deficiency in my office feeling unwell, it was as if he were stuck in the incubation period of an acute infectious-inflammatory illness, unable to become properly and acutely ill because his immune system was too weak to react with the inflammatory healing crisis he needed to clear out his body.

The Role of Antibiotics

All the experts agree that antibiotics are massively overprescribed in the U.S. – used in conditions that don't require them. Why does this overprescribing continue unabated despite large efforts to educate physicians about the proper use of antibiotics? One reason will immediately be recognized by most physicians: almost daily we see patients who come into the office seeking antibiotics. These patients have two chief concerns: either their symptoms are too intense or they've been going on too long, or both.

If we understand the illness to be a housecleaning, then these concerns are very much minimized. "Your immune system is doing a good job – you will soon bring this healthy, much-needed housecleaning to a successful conclusion" is what a physician of the housecleaning persuasion might say. Microbes are an important stimulus, provoking the immune system to react and thereby bringing on the symptoms of acute inflammatory illness. When we kill or inhibit the microbes with antibiotics, we inhibit the immune system at the same time. This inhibits the inflammatory symptoms that belong to an active immune response, creating the illusion that we have healed the illness when in reality we have suppressed the symptoms and interfered with the immune system's work before its job was done. This is a suppression, not a healing, and it is crucial to understand the difference between the two.

Children who are able to have their normal childhood healing crises, consisting of fevers and discharges, thereby exercise and build their cellular immune systems to be strong and resilient, which is a great benefit for their overall health. Vaccinations, antibiotics and anti-inflammatory drugs like Tylenol and ibuprofen all interfere with this inflammatory cleansing of the body and the immune system-strengthening that results.

If we stop housecleaning in order to have some peace, we will have to put up with an untidy house. An untidy house and an inactive housekeeper are conditions that in the short run lead to a return of flies and ants, and in the long run lead to chronic disease and cancer. An important way to prevent cancer is to appreciate the great wisdom and benefit of our occasional inflammatory housecleanings and to refrain from obstructing them unnecessarily with antibiotics and anti-inflammatory drugs. This point was recently supported by the publication of research suggesting that antibiotics increase the risk of breast cancer (Velicer, Heckbert, et al. 2004). Inflammation is the natural enemy of cancer.

Nevertheless, antibiotics are lifesaving drugs when an acute infectious-inflammatory illness becomes dangerous. This danger stems partly from the intensity of the inflammation, but more so, I believe, from the toxicity and the sheer volume of the metabolic wastes and poisons which are stirred up and mobilized by the inflammation. If our organism has the strength to clear out all these toxins and discharge them from our body, the illness usually resolves itself. If we lack this strength, then the discerning physician will attempt to support and promote the discharging, detoxifying process, keeping a watchful eye on the patient's strength, and will use an antibiotic if needed to prevent complications or death from the poisons that have been stirred up by an overzealous immune system. This is a toxic or septic inflammation, and in such a crisis, an antibiotic is a blessing. But the likelihood of our ever having to experience such a toxic crisis will be greatly diminished if we understand how to allow all our smaller, non-threatening inflammatory crises to do their housecleaning work.

* * * * *

In his award-winning book of essays, *The Lives of a Cell* (1974), the dean of Yale Medical School, Dr. Lewis Thomas, confirmed some of the contrarian points I've made in this article. Although he diplomatically avoided the scavenger versus predator debate in the book's essay on "Germs," he readily emphasized the dominant role of the immune system in causing overt infectious/inflammatory illness:

> We can carry brucella [a type of bacteria] for long periods in the cells…without any awareness of their existence; then cyclically, for reasons not understood…we sense them, *and the reaction of sensing is the clinical disease*….it is our response to their presence that makes the disease. Our arsenals for fighting off bacteria are so powerful…that we are in more danger from them than from the invaders. [Emphasis added.]

Research since 1974 has considerably advanced our understanding of how, if not why, our own immune system can make us terribly sick. Dr. Kevin Tracy's *Fatal Sequence: The Killer Within* (2005), focuses on the dreaded medical complication of sepsis with multiple organ failure, which ranks as the third most common cause of death in U.S. hospitals today. Previous generations of physicians, myself included, had been taught that in sepsis the patient's immune defenses are overwhelmed by a massive uncontrolled proliferation of bacteria in the bloodstream, often with lethal consequences. Yet this explanation was severely challenged by the occasional case of severe or even fatal sepsis in which no bacteria at all could be found.

Kevin Tracey's book details the astonishing unraveling of this mystery. In the dramatic life-threatening illness of sepsis, the bacteria are today no longer considered the perpetrators. Now the blame is squarely placed on an overreactive, trigger-happy immune system which can set the whole devastating sepsis process in motion in response to many bacteria, to only a few bacteria, or to no bacteria at all but to other stressors such as surgery, childbirth, blunt trauma, or muscle strain (Stevens 1992). About this potentially lethal overreaction of our own immune system Lewis Thomas observed wryly:

> All of this seems unnecessary, panic-driven…. It is, basically, a response to propaganda…we tear ourselves to

pieces because of symbols, and we are more vulnerable to this than to any host of predators. We are, in effect, at the mercy of our own Pentagons, most of the time. (Thomas 1974)

Today science has identified a number of chemicals called cytokines produced by our immune system. When certain of these cytokines are injected into lab rats, the poor creatures display all the signs and symptoms of sepsis and often they die. But why should the immune system, which we assume has evolved to protect and preserve us, occasionally be the cause of our demise? Medical science usually deals with such paradoxes by ignoring them. It is the "how" that is considered useful knowledge; the "why" is merely philosophical speculation, not an object for serious research. Yet the patient who has experienced a life-threatening illness will almost certainly wonder, at least briefly, "why?" Such a question is not to be dismissed. In most cases I believe the only useful and appropriate answer to the why of illness must arise, if at all, out of the patient's own quest for self knowledge, which it is the physician's role to support with careful discretion.

It is a good sign that more and more patients are finding such a quest to be an essential and salutary part of the illness experience. Our medical paradigm will inevitably change, I believe, so that in the future neither patient nor physician would ever seriously consider that the real reason for a life-changing infectious/inflammatory illness, or even a minor illness, was the random catching of a bug.

Philip Incao is a physician with a family practice in Denver, Colorado. He is a contributing author to The Vaccination Dilemma*, a book about the vaccination debate. He has written widely about how to reduce the fear surrounding childhood disease. This is a revised version of an article that appeared in* Pathways*, the quarterly publication of the International Chiropractic Pediatric Association, no. 6. The author is grateful to Charlene Thurston, Christine Maggiore and Bob Dudney, M.D., for their kind help and advice with this article.*

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Practical Measures

Perhaps the most important point to remember in treating acute infectious-inflammatory illnesses is that *fever is good*, *toxicity is bad*, and *discharge of toxicity is very good.* The danger of an acute infectious-inflammatory illness is not the 105-degree fever nor the yellow thick mucus draining from the nose, but the amount of retained toxicity that is poisoning the patient because it is unable to be discharged from the body quickly enough. It is normal for the ill patient to be weak, lethargic and oversensitive. Symptoms suggesting that excessive retained toxicity is poisoning the body include increasing irritability and restlessness, an increasing look and feel of desperation or anxiety, and a decreasing ability to maintain consciousness and eye contact. If these are happening, call the doctor.

We physicians should be advising our patients how to recognize and treat toxicity. Up to 106 degrees F, the degree of fever is *not* a sign of the seriousness of the illness, but is rather a sign of how strongly the immune system is working to detoxify and clear out the illness. Therefore it is best to avoid fever-lowering drugs.

Here are some effective, age-old ways to support the immune system and to promote a good outcome of an acute infectious-inflammatory illness:

* Total rest and sleep, with as little distraction as possible. No television, radio, tapes or reading. Keep the patient very warmly dressed and covered. Sweating is good. Avoid chilling.
* A liquid diet of vegetable broth, herb teas, citrus juices. Add rice, millet, carrots or fruit if hungry. Absolutely no meat, fish, eggs, milk products, legumes, beans, nuts or seeds. The digestive power of the body must focus on the illness and not be burdened with food.
* Elimination through bowels, bladder and sweating is essential to treat toxicity and prevent its complications. Therefore encourage drinking of lukewarm clear fluids, and use prune juice or Milk of Magnesia to promote loose bowel movements once or twice daily.
* Provide a sick-room environment with warm, soft colors and textures and natural soft light. Include plants and flowers. The caregiver should be cheerful, peaceful, attentive, observant, encouraging, loving and respectful of the profound healing wisdom of the inner housekeeper she is assisting.

Philip Incao

Conversation Between Friends

An Inspiration for Goethe's Phenomenological Method

Christina Root

Goethe was keenly aware of the traditions of thought and practice that influence science. He recognized, in ways that seem very modern to us now, that the search for truth and knowledge in science is always conditioned and shaped by what has come before it, and that traditional ways of conceiving phenomena determine what investigators think is important to study and what they value as knowledge. Goethe was particularly sensitive to the limitations put upon the pursuit of knowledge by these traditions.

Goethe thought that science should be as inclusive of different kinds of thinking as possible, and that there should be many modes of proceeding rather than a single method, no matter how fruitful that method might appear. While he believed that science, like other forms of knowledge, was bound by history, his aim was not to unmask it as ideology; principally, he wanted to show that, as a human endeavor, it was prone to all the dangers and pitfalls of any human enterprise. The best way to guard against those pitfalls was through a schooling of consciousness on the part of the scientist: first to a greater awareness of how theory-laden all seeing is, and then to the development of a sensitivity and flexibility that would allow the scientist to think along with rather than merely about nature.

Goethe regarded different approaches to phenomena as languages, each of which is symbolic and "never a direct expression of the objective world but only a reflection of it" (Goethe 1995, p. 277). We try to capture what we see in various formulations, which essentially behave like metaphors in that they organize our perception in particular ways. In the sixth section of the *Farbenlehre*, he considers the strengths and limitations of different ways of characterizing phenomena. In this passage he treats metaphysical and moral approaches as on par with mechanical, mathematical and "corpuscular" ones—each being imperfect in its own way. Since his time, of course, explicitly moral and metaphysical discourses have been banished from science altogether, perhaps, in part, because of the weaknesses in them that Goethe articulates. Mathematical and mechanical formulations have thrived despite the very real problems that Goethe points out here.

He writes:

> Metaphysical formulas have great breadth and depth, but a rich content is required to fill them in a worthy way; otherwise they remain empty. Mathematical formulas are often convenient and useful, but they always have a certain stiffness and awkwardness; we soon feel their inadequacy, for even in elementary instances we quickly recognize the presence of an incommensurable quality.

Furthermore, he adds that mathematical formulas are

> intelligible only to a narrow circle of specially trained minds. Mechanical formulas speak more to ordinary understanding, but are themselves ordinary and always retain a touch of crudity. They transform living things into dead ones: they kill the inner life in order to apply an inadequate substitute from without. Corpuscular formulas are similar; they have the effect of rigidifying things in motion, coarsening idea and expression. In contrast, moral formulas express more delicate relationships but take the form of simple metaphors and may finally lose themselves in a display of wit (ibid.).

Goethe doesn't despair over these inadequacies, seeing the various languages, instead, simply as what we have at our disposal. He ends with, "the scientist might make conscious use of *all* these modes of thought and expression to convey his views on natural phenomena in multifold language. If he could avoid becoming one-sided and give living expression to living thought, it might be possible to communicate much that would be welcome" (ibid.).

But, what would such a multifold language consist of? The metaphysical and the moral, he says, have a tendency to become disembodied and lose their substance unless filled with "a rich content," whereas the mechanical, mathematical, and corpuscular, by contrast, tend to harden into crude and inadequate reifications of phenomena. If everything we investigate is itself multidimensional, then *any* reductive method that singles out particular aspects will skew our understanding of the phenomenon as a whole. Goethe rejected the idea that there could be two conflicting truths about a phenomenon, one poetic and one scientific, however attractive that idea may be to those who wish to avoid controversy. So the question remains whether a multifold

language would merely be a composite of our available approaches, or whether there might be a way to gain the necessary flexibility of mind and method, as he says, to "give living expression to living thought."

By continually questioning different approaches, Goethe sustained a valuable skepticism, and challenged scientists to seek out different perspectives and make them part of themselves. He stressed the importance of developing capacities that would help avoid the twin dangers of emptiness and rigidity by cultivating an active receptivity within the observer. This kind of active receptivity shares a good deal with the qualities we bring to conversation rather than those we bring to experimentation. The ideal of conversation becomes a model for Goethe of a kind of multifold language that can overcome some of the difficulties inherent in applying a particular method to phenomena.

The Multifold Potential of Conversation

Goethe saw aspects of his own approach to nature as resembling a conversation more than a series of mechanical or mathematical steps, and he was sensitive to the decorum of a good conversation, asking "who speaks here, the object or you?" Like the phenomenological thinkers who followed him, Goethe believed that a full understanding of nature can be best achieved through an open-ended approach in which the investigator participates, rather than through the paradigm of explanation that assumes a detached observer. True conversation involves listening as well as talking, being open to the unexpected, and being willing to change direction. When nature, rather than another person, is the partner, the conversation begins with the acknowledgement that the natural world is "something in its own right" (Holdrege, 2005; Talbott 1993) rather than purely an object of scrutiny. For a conversation with nature to be possible, the observer must assume that the object or phenomenon under study possesses an "inner life" or integrity that can't be easily summed up or explained.

Perhaps Goethe's predilection for conversation as a model for natural investigations was inspired in part by the way his own work was furthered through its being reflected back to him by someone else in a gesture of friendship. In two famous encounters, in particular, sympathetic characterization of himself by another person opened up new vistas of thought to Goethe. In one case, the person approved of his thinking, in the other, the person, namely Schiller, remained unconvinced. But, in both cases, seeing himself mirrored in someone else's thinking helped Goethe develop the method that characterizes his work: the open, generous attention that friends bring to a conversation. Looking at these gestures of friendship in the context of his phenomenological method enlarges our view of what Goethe saw as an important but unacknowledged aspect of scientific study. By foregrounding the effects of friendship on the progress of his own thinking, Goethe sought to develop, by analogy, its role in coming to know the natural world. Cultivating the capacities we bring to friendship helps us to see and experience the relationships among natural phenomena and between nature and ourselves.

Goethe had never been comfortable with conventional ideas about the need for objectivity and detachment in the study of nature. But until he had his ideas fortuitously expanded by an otherwise unremembered Dr. Heinroth, Goethe hadn't been fully conscious of his own potential solutions to the problems objectivity and detachment posed for him. In an essay entitled "Significant Help Given by an Ingenious Turn of Phrase," Goethe writes that Heinroth had spoken favorably of his work, stressing its uniqueness (Goethe 1995, pp. 39-41). "He says my thinking works objectively. Here he means that my thinking is not separate from objects, that the elements of the object, the perceptions of the object, flow into my thinking and are fully permeated by it; that my perception itself is a thinking and my thinking a perception. He does not withhold his applause for this approach." In using the word "objective" in this way, Heinroth sounds a little like Humpty Dumpty in *Through the Looking Glass* who tells Alice in rather a scornful tone "when I use a word it means just what I choose it to mean—neither more or less" (Carroll 1993). But Heinroth's recognition that Goethe tries to mold his thinking to the object, rather than imposing a conceptual framework upon it, demonstrated playfully in his recasting of the word "objective," was just the ingenious help Goethe needed to understand exactly what he hoped to achieve in his studies of nature. One aspect of developing a multifold language is learning to express the unique qualities of each phenomenon. Goethe studied light and color, rocks and minerals, clouds and weather, and plants and animals. In each case he wanted to get to know these phenomena on their own terms.

Heinroth's characterization became the occasion for Goethe to reflect on how best to make progress in the schooling of consciousness that would allow him to manifest a truly object-oriented thinking. He had always felt, he continues in the essay, the inadequacy of the dictum "Know thyself," which he saw as part of a conspiracy to divorce us from the world we are an aspect of rather than separate from. Dr. Heinroth's remarks allow him to see that "The human being knows himself only insofar as he knows the world; he per-

ceives the world only in himself, and himself only in the world. Every new object clearly seen opens up a new organ of perception in us" (Goethe 1995, p. 39). A true objectivity is one that allows the object under study to emerge into intelligibility within the consciousness of the observer. We can also add, every new object *empathetically* seen opens up new capacities in the observer, who through empathy participates in what he or she sees.

In these reflections, Goethe enlarges on Heinroth's view of his thinking, but also begins to understand how his own response as beneficiary of Heinroth's insightful attention expands his thinking as well. Being seen and known in the way that Goethe feels he has been by Heinroth has an important influence on his scientific work. He sees himself reflected back in the mirror of another mind much more clearly than he had been able to see himself alone. By contrast, he goes on to surmise, adversaries can't help him develop his thinking, because they find his existence odious, repudiate his goals and condemn his means of reaching them as "a mere waste of time." "Friends can call attention to my limitations or to the infinite in my being—in either case I listen to them and trust that they will truly instruct me." The predisposition to sympathy itself allows things to come into being that indifference makes impossible. If all our seeing is theory-laden, and all our perceptions presuppose a certain attitude toward what we see, then approaching another person or phenomenon with disinterested generosity may be the key to developing a multifold language that breaks through the limitations of any one language and begins to allow the phenomenon to manifest more fully in thought.

Goethe and Schiller

The second story of the inspiration afforded by friendship is Goethe's famous meeting with Schiller, which he called "A Fortunate Encounter" in his memory of it many years later (Goethe 1995, pp. 18-21). The meeting seems on the surface a very different event—not the unexpected gift of a stranger seeing you steadily and whole, but potentially an encounter with an adversary who thinks your arguments are a waste of time. In his essay on the encounter, Goethe sets up the anecdote by outlining the resistance he had felt to meeting Schiller at all, not having liked his play *The Robbers*, and having felt personally attacked by his essay *On Grace and Dignity*. It may not have seemed an auspicious beginning when they finally did meet, because Schiller refused to enter into Goethe's thinking with Heinroth's empathy.

After a lecture on botany, they struck up a conversation and agreed about how bad the speaker was (always a good icebreaker), but when Goethe was drawn into expounding his ideas on the metamorphosis of plants, even making a quick sketch of what he meant by the archetypal plant, Schiller was not convinced. Goethe writes: "He heard and saw all this with great interest, with unmistakable power of comprehension. But when I stopped, he shook his head and said, "That is not an observation from experience. That is an idea." Schiller refused to grant Goethe the very capacity that Heinroth articulated—for "his perception to be a thinking and his thinking a perception." Goethe's answer shows he had his dander up. He writes, "Taken aback and somewhat annoyed, I paused; with this comment he had touched on the very point that divided us…my old resentment began to rise in me. I collected my wits, however, and replied, "Then I may rejoice that I have ideas without knowing it and can even see them with my own eyes" (Goethe 1995, p. 20).

Despite not getting support for his picture of the plant, Goethe felt buoyed up by the encounter, having gained through it a clearer sense of his own thinking. He again benefited from sincere interest and attention. Schiller's determination to become Goethe's friend despite their differences in outlook was the gift that allowed his critical remarks to work as they did. Intellectually, the two made truces rather than winning the other over, but the next ten years saw their close friendship and a most fruitful collaboration that led to, as Goethe says, "the gradual development of my aptitude for philosophy." The stimulus of their first meeting helped

Goethe recognize the degree to which his own method could be summed up as loving attention to phenomena, whether they were plants, animals, the weather, granite or color and light. Goethe found in his friendship with Schiller the experience of seeing himself in relation rather than in isolation. Through Schiller's response to him, Goethe recognized the ways in which thinking can become identical with seeing. He saw that by beginning with the conviction that nature is alive and "something in its own right" he could set about training his capacity to observe the quality of aliveness "with his own eyes."

Schiller's beam of affection, focused on Goethe, trumped his disagreement with him over the possibility of whether he actually could have the experiences he felt he'd had, and, because it did, had lasting salutary effects. The gift Goethe felt he had received was reciprocated in just the way we would expect in a friendship built on mutual exchange and respect. Soon after their fortunate encounter, Schiller wrote to Goethe, (August 23, 1794): "My recent conversations with you have put the whole store of my ideas into a state of motion….Many things upon which I could not come to a right understanding with myself have received new and unexpected light from the contemplation I have had of your mind (for so I must call the general impression of your ideas upon me). I needed the object, the body, to several of my speculative ideas and you have put me on to the track for finding it" (Schmitz 1977-79). Schiller articulates a similar phenomenon here of "new and unexpected light" shed by the process of understanding one's own ideas through their embodiment in another person's mind.

In his descriptions of both his experience with Heinroth and with Schiller, Goethe emphasizes the unexpected, unanticipated nature of the gift. The epiphany came fortuitously, as something arising within the meeting with the other. These examples of the effects of friendship suggest that gestures of openness transform the participants and consequently open up new vistas of what can be seen. The Goethean method calls for continuous self-examination and self-transformation in just the way a good friendship does. Developing a multifold language is part of the process by which we train ourselves to see from "the perspective of objects," and learn to imagine ourselves empathetically into the position of our partner in conversation.

* * * * *

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