

# CORRESPONDENCE

## OF THE NATURAL SCIENCE SECTION OF THE ANTHROPOSOPHICAL SOCIETY IN AMERICA

JANUARY-FEBRUARY 2021

VOLUME 4 ISSUE 1-2

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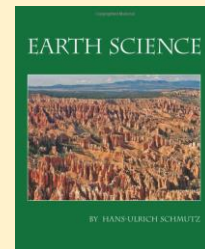
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### ONLINE COLLOQUIA

### THE CLIMATE NEEDS OUR CHANGE

First colloquium Feb. 27<sup>th</sup>

See [p.3-7](#)



### INITIATIVE FOR SCIENCE AND ANTHROPOSOPHY

"What is Qualitative Science?"

By John Barnes

See [p.7-11](#)



## Editor's Note

Not exactly by design, I began writing this note the last day of January and the day after our first online event bringing the Dornach October conference on Climate Change to the English-speaking world. Already our special orientation session has now passed and our first colloquium us upon us with only a week to go. So before I know it, this has become a January-February issue. We will have to keep up with monthly issues, now that we are finally getting our ducks in a row and things in gear for our monthly colloquia.

This issue reports on our recent and current work for our online climate colloquium series. There is a flyer and ancillary material in preparation for our upcoming colloquium featuring the talk by Dr. Hans-Ulrich Schmutz at the October climate conference. Don't miss the delightful vignette from Dr. Schmutz drawn from his years of work with upper grade Waldorf Students.

There is an essay by our colleague, John Barnes, as a contribution for our *Science and Anthroposophy* initiative this month. Then there is an overview of Wolfgang Schad's *Threefoldness in Humans and Mammals* by the book's scientific editor, Mark Riegner, sharing his personal relationship to the book's development. Finally there are some news and calendar items.

For ease of navigation, we have set up the **Contents subheadings as internal hyperlinks** (without underline) and put "Back to top" links at the bottom of each page.

As always, the *Correspondence* welcomes pilot research reports, comments on current scientific research and news, book and article reviews, letters from readers, reports on meetings and workshops, and announcements. There will be editorial review. **For submissions**, click [here](#). We look forward to hearing from you. Please send **feedback** [here](#).

Barry Lia, Ph.D.  
Correspondence Editor



B. Lia (three-color pencil drawing done virtually 'at' [AWE Studio](#))

# “THE CLIMATE NEEDS OUR CHANGE”

## *A series of colloquia building upon the October 2020 Natural Science Section conference at the Goetheanum*

*For the English-speaking world, we are pleased to offer voice-over interpretation of talks originally given in German at the climate conference held at the Goetheanum in October 2020. The conference program was published in our newsletter ([here](#) pp. 4-9). These talks will interest a **broad audience**, encompassing matters social, pedagogical, economic, psychological, and spiritual, as well as scientific.*

### **January 30<sup>th</sup> session**

Professor Meinhard Simon’s live reprise of his presentation for the October Section Conference in Dornach last year is now recorded and “in the can” for future viewing for those who register.

Note that this first event, a live reprise in English, will be unique in our online series. Most presentations were recorded in German during the conference and will be given voice-over interpretation in English. (Find our full series schedule [here](#).)

Some who register for our series of events may be interested only in viewing the presentations from this comprehensive conference on climate change, made available now for the English-speaking audience. That is possible.

We aim to do more with this conference material through our online colloquia, however. The conference presentations themselves will be made available for viewing *beforehand* at one’s liberty. In fact, this recording of Professor Simon’s presentation will actually now serve as one of the two presentations which will be the subject of our colloquium in March.

Some may be satisfied with a single viewing and some may review a presentation in more detail. There may be supplementary material for further preparation *prior* to a given colloquium.

### **February 13<sup>th</sup> session**

Prior to our first colloquium meeting, we held a special online meeting to orient ourselves. One purpose was to simply test the mechanics of zoom breakout rooms and such. Primarily, we wanted to solicit feedback from our

community as to ways we might engage with the presentation material and theme during our colloquia.

Some of us had just “attended” the climate conference held jointly by the Agriculture and Youth Sections. The online engagement here was very innovative and at the far end of the technical spectrum. They used a special virtual conference platform ([hopin.com](#)), with Reception, Stage, Sessions, Network, and Expo functions. I had inadvertently signed up for a Learning Lab at 2AM my time. One had to learn to navigate the platform. I never did find access, before they were gone, to the recorded sessions I’d missed while I slept.

The Learning Lab concept was well conceived. The hosts were well-organized and sent us material in order for us to be prepared for the progressive three-day agenda. Of course, like in a live workshop series, improvisation was called for. They also utilized a Mentimeter function ([mentimeter.com](#)), offering polls and feedback questions for interaction. My computer fan was running on high—in order to keep up with all the video stream and processing demand, I guess.

In any case, that’s toward the far end of the spectrum of virtual meeting possibilities. For our special session on the 13<sup>th</sup>, we simply had a couple breakout sessions, looking for people’s worst and best online meeting experiences. If you have ideas or have experienced innovative and successful ways of engaging online, we welcome your input (send to [editor](#)).

Here is what we learned and our expectations for our initial colloquia: most of you will be students of anthroposophy, and some of you members of the School for Spiritual Science. A few of you will have little or no experience with Zoom and online virtual meetings. We’ll

take some time to go over the mechanics of the mute button, gallery view, breakout rooms, etc.

We expect that you will have viewed the recorded presentation *prior to the colloquium*. We are not merely trying to spare scheduled online meeting time! You'll be able to, and most likely will want to, "rewind" at times. Recording quality and voice-over interpretation won't be as smooth as a live English speaker.

We hope that you will read the particular presenter's bio and abstract in that month's flyer. There may also be ancillary material, referenced in the flyer and/or in our *Correspondence* that month.

There will likely be technical glitches and awkward attempts to bring online the sort of experiential demonstrations as customary during our in-person conferences. This will evolve as we build an online community and culture.

We did promise to publish here passages read aloud during this special session.

First, in contradistinction to our scientific culture today, words spoken by the Old One in Goethe's *Das Märchen*:

"Love does not dominate, it cultivates. And that is more."<sup>1</sup>

And two passages from Charles Eisenstein—the first carrying on this theme:

By denying the nonhuman material world the qualities of a lovable self, we make nature and the material world unlovable. If at bottom the world is composed of a bunch of generic, purposeless particles governed by impersonal, random forces, what is there to love? Locutions such as "natural resources" and even "the environment" foster this kind of separation. Compassionate love comes from the realization you are a self, just like I am. A child looks up at the sun and knows it looks back at her. Then we grow up and know better... But intuitively, we, like the child, like older cultures, [do] know better. We know that the whole world that environs us is a self in all fullness, and so is every part of it.<sup>2</sup>

—the second on the notion not only of a *co-loquium*, but also of a *co-listening*:

I am not suggesting that we adopt, part and parcel, indigenous cosmology. We need not imitate their shamanic practices or learn to listen to bubbles in the water. What we must do is embrace the core understanding that motivates the attempt to listen to water in the first place: the understanding that nature is alive and intelligent. Then we will find our own ways of listening.<sup>3</sup>

### February 27<sup>th</sup> colloquium

Our first colloquium will feature the presentation by **Hans-Ulrich Schmutz**, "From cosmic-impulsed climate change to anthropogenic-induced climate disruption."

**Reminder: we will not be viewing the presentation during our colloquium.** A link to the recording of the talk will be sent to those who have registered, together with the Zoom link. Having a production team spread across the States, the UK, and Dornach, we have only just now managed to post the prepared recording—not as early as we had hoped. We are grateful to have Bernard Jarman's skillful voice-over interpretation.

Meanwhile, please read the article by Dr. Schmutz published in our Sept-Oct 2019 *Correspondence* ([here](#) p.6-10). This article was published in preparation for our 2019 conference, "What is the Earth Asking of Us?" The scientific details behind this talk will be found there. The talk itself will also speak to pedagogical aspects of working with youthful forces to develop living thinking about the world. Celestial rhythms and the paleoclimate will be illustrated by his own students' work on the subject. Dr. Schmutz has published a comprehensive curriculum for teaching Earth Science in the high school.

A review of his curriculum book and a delightful vignette from his life of teaching may be found below, following the flyer for the event.

We look forward to meeting with you "at" our first virtual colloquium on the 27<sup>th</sup>.

<sup>1</sup> *Das Märchen* is also known as *The Green Snake and the Beautiful Lily*. As quoted in *The University at the Threshold*, by Nigel Hoffmann, p.5 (2020 Rudolf Steiner Press; translator unknown). Original passage: "Hierauf

sagte der Alte lächelnd: Die Liebe herrscht nicht, aber sie bildet, und das ist mehr."

<sup>2</sup> Charles Eisenstein, *Climate: A New Story*, p.152.2 (2018, North Atlantic Books).

<sup>3</sup> *Ibid.*, p.258.1.



# WHAT IS THE EARTH ASKING OF US?

*A series of colloquia building upon the October 2020 Natural Science Section conference at the Goetheanum, “The CLIMATE needs our CHANGE.”*

*For the English-speaking world, we are pleased to offer voice-over interpretation of talks originally given in German at the climate conference held at the Goetheanum in October 2020. The conference program was published in our newsletter ([here](#) pp. 4-9). These talks will interest a **broad audience**, encompassing matters social, pedagogical, economic, psychological, and spiritual, as well as scientific.*

**Online Colloquium: Saturday, Feb. 27<sup>th</sup>** (11 am PT, 8 pm CET).

## Featured Presentation:



**Hans-Ulrich Schmutz** Born 1945. Study of geology with Promotion 1973 at the Swiss Federal Institute of Technology in Zurich. Seven years of social work with students in Zurich and then eighteen years as a senior teacher for geography and technology at the Rudolf Steiner School in Wetzikon, Switzerland. From 1982, beginning periodic teaching as a freelance guest lecturer at the teacher training institutions in Kassel, Kiel, Mannheim, Moscow and Witten Annen. Specialized courses for geography in Brazil, Finland, Italy, Japan and Georgia. Geological publications and author of books on the topic of geography at the upper and lower level.

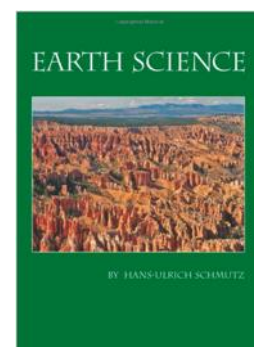
## From cosmic-impulsed climate change to anthropogenic-induced climate disruption

Geological documents in marine sediments and ice cores largely show a convergence of the slowly occurring climatic temperature changes with the variation of solar radiation through the ice age periods, which represents an image of the long-period cosmic rhythms. In contrast, the radically changed and accelerated carbon turnover has documented a change in the temperature trend since the beginning of the industrial revolution, so that the impulse by the cosmic rhythms has been overridden. Civilizing work in harmony with nature requires taking seriously and dealing honestly with the actuality of cosmic rhythms.

## Colloquium Preparation:

**Reminder:** *we will not be viewing the presentation during our colloquium.* A link to the recording of Dr. Schmutz’s talk will be sent to those who have registered, together with the colloquium Zoom link.

Besides **pre-viewing** the recording in preparation for our colloquium, please read Dr. Schmutz’s **article** in an earlier issue of our *Correspondence* [here](#) (pp. 6-10). This article was published in preparation for our 2019 conference, “What is the Earth Asking of Us?” The scientific details behind this talk will be found there. The talk itself will also speak to pedagogical aspects of working with youthful forces to develop living thinking about the world. Celestial rhythms and the paleoclimate will be illustrated by his own students’ work. Dr. Schmutz has published a comprehensive curriculum for teaching earth science in the high school. A **review** of his book and a delightful **vignette** from Dr. Schmutz from this work with students over the years may also be found below.



**Register [here](#). See schedule [here](#).**

*Look for further announcements from this collaboration of the Natural Science Section of the Anthroposophical Society in America, the Natural Science & Math Group of Great Britain, and the Natural Science Section at the Goetheanum.*

## Vignette from Dr. Hans-Ulrich Schmutz

To be able to give this lecture in this way, I owe it to the high school students I was able to teach for 18 years at the Rudolf Steiner School in Wetzikon, Switzerland. The students asked me again and again through questions and actions to shape the geographic and technological lessons with them in such a way as to meet a special inner feeling: I want and can take responsibility for future work on earth.

An example from working with the students: As in many Rudolf Steiner schools, it is in the program that each student in the 12th grade has to complete an individual thesis of their own choosing. In 1990, five students came to me as class supervisor and suggested that they work as a team on a joint thesis because the project was too big for one person. They wanted to build a solarmobile. I took the school's stance and said that everyone had to do a project individually. The students said it was impossible, and I should convince the college of teachers to make an exception here. So, it came about, and in 8 months of intensive work the self-planned, self-financed, and self-built solarmobile was created—a two-seater with an additional pedal drive and a closed fiberglass body.

The five students were able to submit their vehicle with a range of 120 km at an average speed of approx. 50 km

per hour in a competition, "Swiss youth researches the future," organized by the global company ABB, which built nuclear power plants. All submitted projects were exhibited in a large hall the evening before the award ceremony. There stood the elegant vehicle, with a large sticker on the body, the famous sticker with the sun and the text "Atomic power, no thanks." On the day of the award ceremony, the contributions could be viewed by celebrities and the press. And the sticker on the solar mobile had been removed by the organizer's staff. The first prize with a large amount of money went to our five students! They then stood on the stage and refused the award because the sticker had been removed. They called it intellectual theft. They would only accept the prize if a new sticker was put back on. But that didn't happen, and the award went to someone else.

Such presence of mind and moral attitude shapes the future.



## Book Review: *Earth Science*

By Hans-Ulrich Schmutz, PhD

Reviewed by Ronald Koetzsch (from the Waldorf Publications website, July 2017; available [here](#))

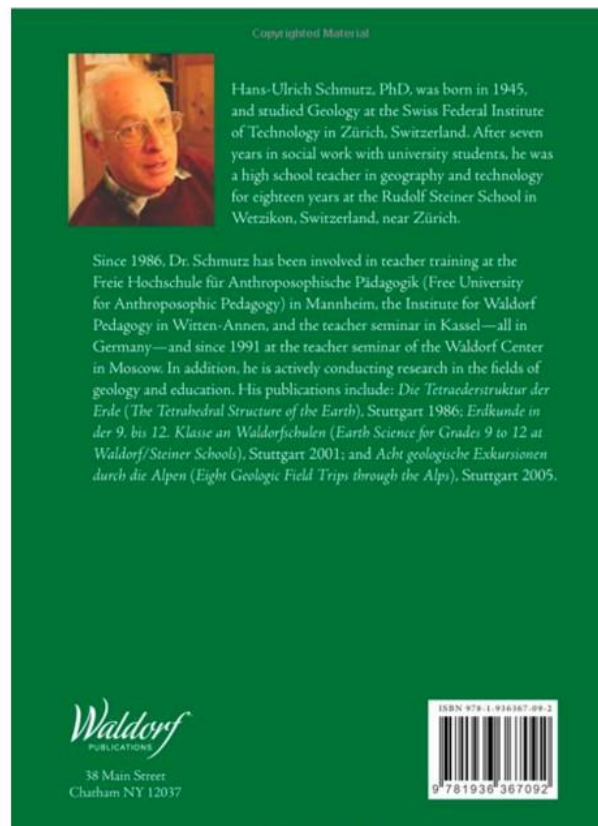
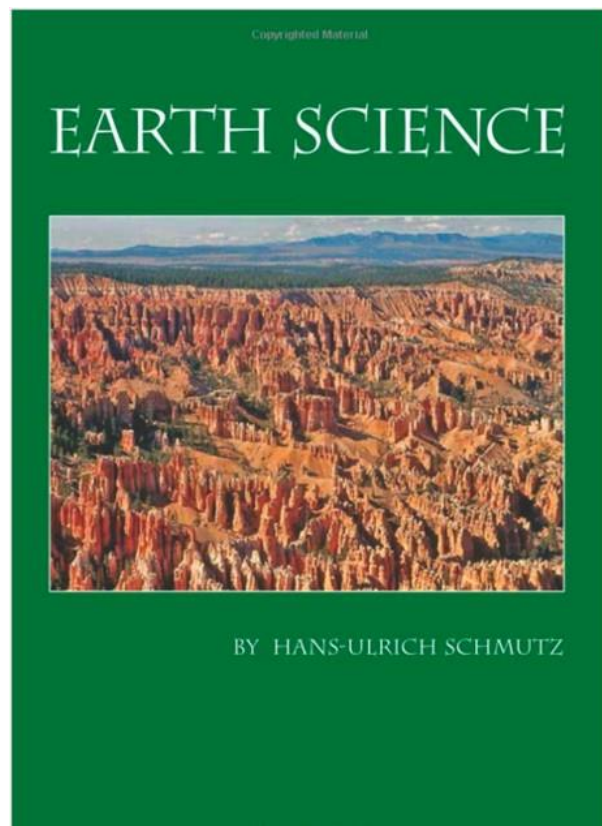
Many Waldorf parents and Waldorf teachers regret that they themselves did not receive a Waldorf education. But parts of the Waldorf curriculum can be studied and experienced at any age. *Earth Science*, by Hans-Ulrich Schmutz, although meant as a guide for Waldorf high school science teachers, gives any rueful adult the opportunity to work through the rich Waldorf earth science curriculum for grades nine through twelve.

Schmutz studied geology at the Swiss Federal Institute of Technology in Zurich and later taught geography and technology for eighteen years at a Waldorf school near Zurich. In *Earth Science* he has distilled his knowledge and experience and provided a step by-step guide for covering the various earth science topics in the high school.

The book contains informative and interesting sections on geology; "the earth in motion"—the circulation of water and wind and plate tectonics; crystallography and the seven crystal system; surveying; astronomy; the economy of energy renewable and nonrenewable sources; paleontology, anthropology, and evolution; and nutrition in the world economy.

Although the subject matter is often technical in nature, the writing is clear and understandable. Schmutz's treatment of these topics is rigorous and scientific but consistently points to the living relationship between Earth and the human being. It is also imbued with a sense of wonder and gratitude at the marvelous, beautiful, and complex planet on which we human beings live.

Front and back cover photos follow on the next page:



## Initiative for Science and Anthroposophy

Given all the attention demanded in the run up to the first in our new series of online events (above), the planned précis and summary of the first chapter of Peter Heusser's *Anthroposophy and Science* has been delayed.

We have the honor, however, of beginning this initiative with an essay, "What is Qualitative Science?", by John Barnes, who served many years on our Section steering committee.

As publisher for Adonis Press<sup>4</sup>, John has shepherded many books on Goethean phenomenological science, always with impeccable attention to detail and aesthetics, including most recently Wolfgang Schad's *Threefoldness in Humans and Mammals* (see overview by Mark Riegner below).

John edited *Nature's Open Secret* for Anthroposophic Press, an edition of Steiner's introductions to Goethe's scientific writings,<sup>5</sup> to which he added a supplemental

essay. This essay now appears in expanded book form as *The Third Culture: Participatory Science as the Basis for a Healing Culture*.<sup>6</sup>

It is hoped that following essay from the Adonis Press website will encourage readers to turn to John's inspirational book, longing for the birth of a healing culture.



<sup>4</sup> <http://www.adonispress.org/>

<sup>5</sup> <http://shop.steinerbooks.org/Title/9780880107150>

<sup>6</sup> <http://www.adonispress.org/the-third-culture.php>

## WHAT IS QUALITATIVE SCIENCE?

By John Barnes

We live in a science-based culture dominated by measurements, graphs, statistics and calculations. The more we think in terms of quantity, however, the more we value the richness of qualitative experience which we seek for in nature, the arts, in religious experience and in human relationships as an inwardly fulfilling, yet elusive antidote to our obsession with numerical accuracy. In the end, most of us would choose quality over quantity. But “subjective” qualitative experience is discounted in our “objective” science-based culture. Indeed, it is thought of as the antithesis of scientific objectivity. Is there—can there even be—such a thing as qualitative science?

### *What are qualities?*

We generally distinguish between good quality and poor quality when we judge almost anything: shoes, tools, even education and human relationships; food, water, soil, etc. Man-made products are of good quality when they are well made, durable, and fulfill their intended purpose well. Water is of good quality when it is uncontaminated and fresh and optimally fulfills its life-sustaining role. An apple is of good quality when it is of a crisp, firm consistency, is moderately juicy, and has a somewhat sweet and slightly tart taste. In this sense we might say that the quality of something depends on the degree to which it realizes its full potential.

But we also use the word to distinguish between, for example, the distinctive qualities of different colors, sounds, or smells, of different kinds of fruit, or of different medicinal herbs. Snowdrops, daffodils, and tulips are all spring flowers, yet each has its distinctive quality. Dogs and cats are both carnivores, yet in their form and behavior they too exhibit very different qualities. In this sense different qualities denote different ways of being.

We also speak of human qualities such as integrity or kindness, arrogance or selfishness. These are inner, moral qualities that, though no longer directly sense perceptible, nevertheless manifest in a person’s facial expressions, words, gestures, and

actions. Though they cannot be measured, they are certainly potent realities.

Following this line of thought, one might say that qualities are the inwardly experienced manifestations of the essential nature, or innate organizational principle of things—manifestations of something internal, essential, or spiritual that come to expression in a more or less potent and complete way in the outer, phenomenal, physical world. Goethe spoke of qualitative experience as “a revelation that comes from within as we immerse ourselves in the outer world.”

Qualitative judgments are based on our experience of things and how we feel about them. If there is to be a qualitative *science*, however, it cannot be based on subjective personal reactions or preferences. And yet if it is to be a science of *qualities*, it must necessarily involve our human experience and feelings. A prerequisite of a qualitative science is therefore not only a highly sensitized and perceptive sensorium but also a highly cultivated, empathetic feeling capacity that has transformed its subjective experience of personal or acculturated likes and dislikes into an objective capacity to perceive qualities as they are: as manifestations of the essences of things.

### *How would a qualitative science differ from modern quantitative science?*

One might say that modern science began with Galileo, who said: “Measure what is measurable and make measurable what is not measurable.”

All scales of measurement consist of identical abstract units—quantities—that can be placed into mathematical relationships.

These relationships can be formulated with great accuracy. This is especially evident in the realm of mechanics. Thus, for example, there is a precise mathematical relationship between the forces at work in a balancing beam or lever.



Qualities themselves cannot be measured. Measurements are abstractions; qualities are by nature concrete and experiential. Whereas measurements and quantitative analyses, if done carefully, are always exact and can be expressed in exact mathematical terms, qualities can only be directly *experienced* and expressed in terms that somehow convey, or point to, this experience. This is a major reason why, wherever possible, qualities have been eliminated from the exact sciences.

In materials science, the specific weight, hardness, tensile strength, malleability, melting point, electrical conductivity, etc., of physical substances can be measured. All such measurements, however, are indications of the qualities of a substance. Chemical reactions reveal aspects of the innate qualities of substances. A distinctive attribute of iron, for example, is that it oxidizes, i.e., undergoes a burning process, when it comes in contact with oxygen. When this chemical reaction is reduced to an abstract quantitative formula— $4\text{Fe}^{2+} + 3\text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3 + \text{heat}$ —our understanding gains a certain accuracy but loses its concrete, experiential nature. A thin layer of this iron oxide, or rust, forms on iron's surface over extended time. When an axe is sharpened on a grinding wheel, on the other hand, tiny fragments of steel fly into the air and immediately ignite as sparks. Rust formation and this sparking are quite different in quality: Rust formation is a slow, corrosive process, enhanced by water, that returns iron to its dull, inert earthly state (iron ore); sparking happens instantaneously, releasing light and warmth, and oxidizing iron in an excited state. Though they can both be represented by the same quantitative formula, the qualities of these two processes are polar opposite in nature.

Colors, tones, smells, tastes, and warmth or cold are sense-perceptible qualities that arise in connection with physical conditions. Tones arise in connection with vibrating material and are propagated through space by mechanical air waves. Depending on how they are produced, tones can evoke feelings that range from the painful to the sublime. Mechanical vibrations are physical phenomena in space that can be measured and counted. Tones are experienced through a highly developed organ—the ear—and speak directly to our feelings. A similar relationship exists between color and electromagnetic oscillations and between smell or taste and certain chemical substances. In each instance, an intimate relation exists between a sense perceptible, yet

inwardly experienced, quality and a measurable, quantifiable physical substrate.

Qualities play a vital role in the arts. The arts are human creations and are deeply bound up with human sensations, feelings, emotions, and intentions. Musicians will tell you, however, that music is lawful and, though it springs from the deepest sources of human experience, it is by no means an arbitrary creation. Much has been written about the qualities of various musical instruments, of different keys, and different musical compositions.

### *Early prototypes of non-quantitative science*

Around 1800, at a time when modern science was just about to plunge into materialism, the great German poet Johann Wolfgang Goethe developed fundamental aspects of a non-quantitative scientific method rooted in human experience that leads to a dynamic and qualitative understanding of nature.

In botany, he developed his view of the metamorphosis of plants, a morphological approach based on exact imaginative participation in the development of individual plants throughout their life cycle. To Goethe, with his strong imaginative capacities, it soon became clear that there were often transitional forms between seed leaves and fully developed foliage leaves, for example, or between petals and stamen. By inwardly recreating the sequence of developing organs in his imagination, he came to see them as the result of the continuous transformation, or metamorphosis, of a leaf-like organ-forming potential that usually manifests physically only in the discrete regular organs of the actual plant but sometimes also in unusual transitional forms. For Goethe, metamorphosis was not only nature's way of creating the various organs of individual plants but also her way of creating the immense variety of plant families and species out of a formative potential that he called the "Urpflanze," or "archetypal plant."

However, while Goethe's dynamic morphology is phenomenological and requires active inner imaginative participation, it is not yet qualitative. The fact that the organs of the blossom are metamorphosed leaves or that lilies are specific manifestations of the archetypal plant tells us nothing about the particular qualities of blossoms or lilies. Whereas metamorphosis is preoccupied with

the dynamic generation of forms, qualitative science seeks to identify the essential nature of things as qualities that manifest in every aspect of their outer appearance.

Goethe does venture into qualitative science, however, in his greatest scientific work, his *Theory of Colors*. In the sixth and final section of this extensive and thorough study of color, a section entitled “the sensory-moral effects of colors,” he investigates the qualities of colors and color combinations. In introducing his method of inquiry, he writes in § 763:

*"In order to experience these particular effects optimally, one must surround the eye completely with one color, for example in a room of one color, or by looking through colored glass. One thus identifies oneself with the color; the color attunes the eye and mind with itself so that they are in unison."*

In his “Verses in Prose,” he writes of this qualitative science:

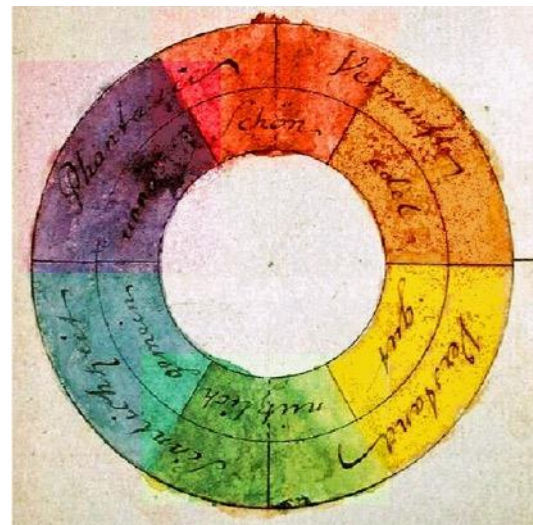
*"There is a delicate empiricism which identifies itself intimately with the object and, in doing so, becomes the actual theory. This heightening of our spiritual capacity, however, belongs to a highly cultivated age."*

Empirical perception is only the first step. It needs to “identify itself intimately with the object,” i.e., one needs to deepen, enliven, and thus inwardly unite with one’s empirical experience. In order to become scientific knowledge, this experience then needs to be compared and contrasted with a range of other qualities in its field. Finally, the lawfulness inherent in these experiences and their interrelationships needs to be formulated. This cognitive process, however, never separates from the qualitative experience. The thinking involved never becomes abstract. Instead, it brings order into the richness of experience. Thus a “feeling understanding”<sup>7</sup> arises. Finally, the “actual theory,” the lawfulness of the experience, can be formulated.

In Goethe’s color circle the six primary and secondary colors are arranged in such a way that neighboring colors blend one into the other and opposite colors are complementary. While gazing for a time at yellow for example, the eye generates

violet, the complementary color, which appears as an after image when one shifts one’s gaze from the yellow onto a white surface. Green is at the bottom of the circle; magenta, or pure red, at the top. Inherent in this arrangement are fundamental dynamic relationships between the colors, all of which Goethe had previously explored—relationships that include, indeed in a sense culminate in, their “sensory-moral” qualitative aspects:

Goethe characterizes yellow as warm, expansive, and cheerful or major in mood; blue as cold, receding, and sad or minor in mood. When yellow intensifies to gold, orange, and red, it grows in strength and power as it darkens. When cyan intensifies, merging into royal and deep blue, then into violet as it darkens, it takes on an increasingly intense inwardness. Where the red and violet merge at the top of the color circle, a pure red appears that inclines neither toward orange nor toward violet. When lightened, it becomes magenta, or rose-red. In this pure red the restless intensity of the orange-red and violet is resolved into a heightened peacefulness. Goethe describes its quality as “ideal satisfaction.” By contrast, green is achieved through the passive mixing of yellow and blue, and he characterizes its quality as “real satisfaction.”



Thus, through his “delicate empiricism” Goethe discovered a complex of lawful, theoretically transparent interrelationships between the qualities of the colors of the color circle. In his essay “Colour is where you see it,”<sup>8</sup> Michael Wilson

<sup>7</sup> A formulation of Rudolf Steiner’s borrowed from his lectures on color: *Colour* (2<sup>nd</sup> edn. 1996, Rudolf Steiner Press) Lecture 5 (1 January 1915), p. 80.

<sup>8</sup> Michael H. Wilson, *What is Colour? The Collected Works*, edited by Laura Liska and Troy Vine (2018, Logos Verlag Berlin) p.187-198.

describes these interrelationships as "an interplay of forces which we feel and see, even though we cannot measure them directly. These are not abstract mental constructions, superimposed on the phenomenon of colour itself; they are direct perceptions of the very nature of colour as part of the objective structure of the world."

In life we are constantly called upon to make qualitative judgments. In all cases, qualitative judgments arise when a kind of echo is called forth from within us in response to an experience that comes to us from the outer world. Our judgment arises as we attune what comes from within us to the outer experience until they resound *unisolo*, as Goethe put it. This process occurs according to the ancient principle: "Like knows like." In other words: We can only recognize a quality in the world if we have it within us. Ultimately, the human being is potentially a microcosm of the world. Goethe, as a poet, playwright, *and* scientist, was well aware of this principle and its profound implications for human life. He often warned of the danger of restricting our world view to what can be ascertained by a purely quantitative science:

*"Insofar as we make use of our healthy senses, we ourselves are the best and most exact scientific instruments possible. The greatest misfortune of modern physics [and I would extend this to all of modern science J.B.] is that its experiments have*

*been set apart from the human being, as it were; physics refuses to recognize nature in anything not shown by artificial instruments, and even uses them to limit and to prove what nature can accomplish."*<sup>9</sup>

Quantitative science has brought us technology and mastery of the material world. But it has also separated our understanding of the world from our experience of it and reduced its qualitative richness and depth to mechanistic concepts. Thus, we have become accustomed to viewing nature as natural resources to be exploited rather than as manifestations of divine creativity. This isolation of the human being from the fullness of reality has led to increasingly severe environmental, health, and social problems. It is therefore becoming a matter of increasing urgency that qualitative science be recognized and practiced as a complement to quantitative science. Qualitative science will re-connect us with the world and lead us forward to a culture that recognizes and works with the creative spiritual sources of reality while maintaining the rigor and conceptual clarity that we have gained through quantitative science. Qualitative science and the healing culture it will usher in will rest upon two pillars of experience: rigorous meditative and artistic practice that enliven and deepens our inner life, and the practice of Goethean "delicate empiricism": openness to the richness of experience that comes to meet us from the outer world.

Photo: B. Lia

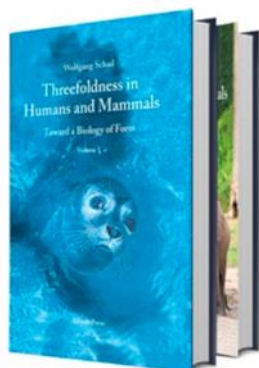


<sup>9</sup> Goethe, "Maxims and Reflections" in Miller (ed), *Scientific Studies. The Collected Works* Vol 12, (1995, Princeton Univ. Press) p.311 [transl. here by JB]



# Book Overview

by Mark Riegner  
Scientific Editor



## Threefoldness in Humans and Mammals Toward a Biology of Form

9780932776648

\$125.00

Hardback

Available

**Wolfgang Schäd**, author

Mark Riegner, editor

Catherine E. Creeger, translator

2-Volume Slip-cased set

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**Adonis Press** (John Barnes, publisher)

About 5,400 species of living mammals are distributed over the face of the Earth, from polar seas to icy mountaintops to humid tropical forests. Because mammals generate their own internal body heat, they have been able to colonize almost every ecological niche available, and even make forays to the deepest ocean depths. Mammals run, crawl, hop, swim, dive, climb, gallop, burrow, and fly. Some wild mammals have almost never been seen in their natural environments, while others regularly visit our gardens and backyards and even take up residence in our dwellings. We have hunted mammals for food, leather, bones, and furs since before the dawn of human civilization, and we have, to varying degrees, domesticated mammals around the world for these same products as well as for work, transportation, research, and companionship. We, too, are mammals, and we have gotten to know ourselves better by living in close proximity to, and seeking to understand, the mammals that co-inhabit our world.

But for all we have learned about mammals, many questions remain. Why do some live in social groups while others are solitary? Why do some species have a high capacity for learning while others exhibit more stereotypical behaviors? How are species integrated into their ecological communities and how do they, in turn,

influence those communities? What has driven the evolution and diversification of mammals across the Earth? Why are some groups very diverse while others have relatively few representatives? In addition, even more basic questions regarding the form of mammals remain unanswered, and many interesting questions have yet to be broached. For example, why do some deer have relatively short antlers that sprout from the skull and grow more or less straight upward while others have large branching structures that lean backward or even extend laterally? Similarly, why do the horns of certain antelopes point upward like spikes while other species have horns that describe beautiful spirals that extend both upward and laterally? Why are many rodents countershaded while a significant number of members of the cat family exhibit spots, vertical bars, or horizontal stripes? What can we learn from the developmental trajectories of different groups of mammals, including their condition at birth, and how do these correspond to the adults' morphology, physiology, and even behavior?

Clearly, some of these questions, and countless others, have been investigated, and while we have achieved insights here and there, we still lack an overall satisfactory synthesis of many of these details, especially regarding how they interrelate to each other. For example, regarding the evolution and diversity of mammalian color pattern, besides the obvious benefits of camouflage, background matching, and cryptic coloration, we still can't say why we find very different color patterns in closely related species, such as the Brazilian tapir and Malayan tapir, and, conversely, why distantly related species show remarkably similar color patterns, such as a bold black-and-white pattern: for example, the Malayan tapir, guereza colobus, giant panda, and orca. And regarding the guereza colobus, is it merely an accident of evolution that it lost its thumbs? A result of natural selection? Genetic drift? Is this digit reduction at all related to the monkey's bold color pattern? Its leafy diet? Its digestive physiology? Its social structure? The giant panda, too, has a leafy diet. Is there a connection or, in more technical terms, is this the expression of an evolutionary convergence with the guereza colobus? To my knowledge, these and similar questions have not been posed, at least in the scientific literature, but they could hold the key to understanding evolutionary processes in the context of whole-organism



biology. They do, however, require an adept interpreter and a new method of contextualization. This brings us to the current project and the lifetime contribution of Wolfgang Schad.

I first met Wolfgang Schad's work when I was a grad student in New York in the late 1970s. I had heard there was a recent publication (1977) of a book that offered a new, comprehensive approach to understanding mammalian morphology, drawing on Goethean and anthroposophical science. In a stroke of serendipity, while browsing through the shelves of a secondhand bookstore, under the "oceanography" section, I slid out a hardcover, blue-bound text: *Man and Mammals: Toward a Biology of Form*. It was misplaced on the oceanography shelf, presumably because there was an image of a seal on the cover! Anyway, I paid five bucks and thus began my journey toward a reorientation to mammalian biology. A few years after, I had the good fortune to meet with the author in Stuttgart, Germany. Subsequently, through yet other serendipitous events, while I was living at Emerson College in England, I proposed to *Orion Nature Quarterly* to write an article summarizing Wolfgang Schad's book. Little did I know that Dr. George Russell, Editor-in-Chief of the magazine, and Adelphi University Biology Professor, had been the driving force behind having *Man and Mammals* translated into English and published by Waldorf Press! I imagine the editors were delighted when they received my proposal. Another stroke of luck was a good friend from graduate school, Fiona Reid, was living in England at the time, and she agreed to paint the illustrations for the article (she has since written and illustrated numerous books on mammals, including *The Peterson Field Guide to Mammals of North America*, 2006), and thus appeared "Horns, Hooves, Spots, and Stripes: Form and Pattern in Mammals" (1985; revised and reprinted in 1998 in Seamon and Zajonc's collection on *Goethe's Way of Science*). Needless to say, it was a great honor and privilege, and even somewhat daunting, to have been asked to serve as the scientific editor for this new, revised, long-anticipated, and significantly expanded edition. In what follows, I hope to provide a context to Schad's work, as well as highlight just a few of the remarkable contributions to understanding mammalian biology offered by this project.

In recent years, in partial response to the explosive development of molecular biology, there has been a call to return to studying the whole organism, so-called whole-organism biology (e.g., Nicholson 2014, Rosslenbroich 2016). Not simply a knee-jerk reaction against the excesses of scientific reductionism, this is a well-considered attempt to invite us to look more deeply at the living organism in an effort to answer questions left in the dark by gene-centered research

programs. For example, we still cannot satisfactorily explain what constitutes the coherence of an organism, what guides developmental processes, how the genotype is translated into the phenotype, or how anatomical structures and organs typically grow where they're supposed to grow in the right dimensions and in the right configurations. Clearly, this is an exciting time in biology, and there are numerous theoretical and experimental developments that are pressing against the boundaries of a purely reductionist approach. Such developments include the findings of heterochrony, epigenetics, evolutionary developmental biology (evo-devo), gene networks, developmental trade-offs/compensations, and others. Each area, in its own way, calls on a new appreciation of the whole organism as the key to generating new paradigms regarding the natural world.



Figure 1. Abert's Squirrel (*Sciurus aberti*), a rodent, emphasizes the nervous and sensory systems, as expressed in its small body size, posterior emphasis, and countershaded color pattern. (Photo by MR; Prescott, Arizona)

Wolfgang Schad, however, has not just of late heeded the call to appreciate the whole organism but has devoted a lifetime to this very endeavor; in fact, especially for those who are familiar with his previous work, it is evident that he has pioneered such an approach, not only in the study of mammals, but also in his diverse work on morphological patterns of European trees, on heterochronic evolution of the major classes of vertebrates (Schad 1993), and on the shaping of stone tools among early hominins. Clearly, however, none of these studies approach the remarkable, even monumental, breadth and depth of his work on mammals. Before I review some of the insights described in this book, I will briefly review the sources of Schad's inspiration, as I understand them, and the guiding motifs that inform his scientific inquiries.

Undoubtedly, as described in detail in Chapters 1 and 3 and throughout, Schad draws heavily on the scientific writings and inspiration of the great German poet—and naturalist!—Johann Wolfgang von Goethe (1749-1832), as well as from the Austrian philosopher, educator, and polymath Rudolf Steiner (1861-1925), who, as a young man, directed much effort toward interpreting and editing Goethe's scientific writings, as well as describing the epistemology implicit in Goethe's scientific worldview.

A key theme in Goethe's phenomenological approach to nature observation, whether applied to plants, weather patterns, or even geology, was the notion that phenomena sort themselves according to polarities: light-dark, contraction-expansion, inhalation-exhalation. Grounded in this perspective, phenomena were seen to transform, or *metamorphose*, between polarities. Thus, if one observes the leaves spiraling up the stem of a typical annual plant, such as Common Ragweed, one first notices small leaves expanding from the base toward the middle of the stem and then contracting toward the apex. No two leaves are identical, yet they are related and, in their diversity, give expression to a dynamic continuum. Goethe called this phenomenon "metamorphosis" and regarded the space between the leaves to be as critical to understanding the whole phenomenon as the actual leaves themselves.



*Figure 2. The African buffalo (Syncerus caffer), a hoofed mammal, emphasizes the metabolic and limb systems, as expressed in its formidable size, anterior emphasis (enhanced by horns), and uniform dark color pattern. (Photo by MR; Maasai Mara National Reserve, Kenya)*

Clearly, I cannot begin to do justice to a description of the subtleties and power of Goethe's way of science in this brief overview. However, *Threefoldness in Humans and Mammals* is perhaps the broadest and deepest application of this approach that has been published to date. For readers wishing an entry into this discipline in the English language, both philosophical and applied, I

recommend the edited collections by Amrine et al. (1987) and Seamon and Zajonc (1998), as well as selected articles and books (Brady 1987, 1998; Bortoft 1996, 1998, 2012; Holdrege 2005, 2013; Riegner 2013; Heusser 2016); note, however, that there are different philosophical approaches to Goethe's way of science, and Wolfgang Schad may not be in agreement with the epistemological context of all the references listed above. In addition to these works inspired by Goethe, helpful English translations of Goethe's own writings include Goethe (1790) and Miller (1995). Note that Rudolf Steiner further articulated and explicated Goethe's dynamic concept of polarity and thus arrived at the notion of "threefoldness," which he applied to many phenomena, especially aspects of the human physical, psychological, and spiritual organizations. From the title of Schad's book, it is evident that the theme of threefoldness is central to the entire project. Steiner also published numerous books (two translated into English) that describe Goethe's contribution to a dynamic apprehension of nature and morphology, a term Goethe coined (e.g., Steiner 2008).

In this book, Schad applies Goethe's dynamic way of seeing, further elaborated by Steiner's threefold principle, to an apprehension of the morphology, physiology, diversity, behavior, ecology, etc., of mammals. The guiding motif is the recognition of the expression within the world of mammals of a dynamic threefold physiological and anatomical relationship: the reader is led to see how the nerve/sensory system and the metabolic/limb system constitute a polarity, and this polarity is mediated by the rhythmic (or circulatory/respiratory) system. In tracing how these systems are, to varying degrees, emphasized or de-emphasized in actual species, and what the resultant relationships reveal, the conventional classification of mammals is not discarded but elaborated with additional levels of interpretation. Based on a recursive dialogue between the whole and the parts, Schad leads the reader step-by-step through the wonderful diversity of mammals until, at some point, the engaged reader will be able to "see" the weaving of "mammalness" through the diverse forms or, in other words, to grasp the whole through the parts. Readers, especially those more scientifically inclined, should be aware that, regarding the shifting debates on classification and taxonomy, Schad intentionally aligns his views with those of the so-called "lumpers"—those who tend to place into one "species basket" geographic variations of a given species—as opposed to those of the "splitters"—those who tend to partition geographic variants into separate species. By doing so, the plasticity of nature can perhaps be more readily grasped. A case in point is that of the giraffe, which in this book is treated in the traditional sense as a single species with numerous

subspecies, rather than the four species recently identified through genetic analyses (Fennessy et al. 2016). As discussed in Chapter 11, genetic analyses can be misleading, as well as equivocal, and, in this particular case, there has been no test of the Biological Species Concept to determine if the various giraffe subspecies are reproductively incompatible with each other, a key criterion for separation into distinct species.

What lies in store for the reader of *Threefoldness in Humans and Mammals*? Clearly, it is futile to attempt here to summarize or outline a work of this magnitude, with some 1,300+ pages divided into two volumes! Similarly, a review of the main points would entail a separate treatise. I will, however, simply point to just a few highlights to offer a glimpse into what readers will discover. For example, in Chapter 10 on the deer family, we encounter a masterful, in-depth exploration of cervid morphology. This, as for other chapters, can easily stand as a separate monograph. Schad deftly, and in remarkable detail, outlines the morphological transitions, or “metamorphosis,” between and among the living (and extinct) species of deer. The astute reader will learn that, far from being a random growth of bone, the antlers of deer are precise indicators of the constitution of each species. Thus, whether the antlers grow laterally, straight upward, or first grow toward the posterior and then, at the tips, turn forward, all hold significance and are correlated with every other feature within each species. It’s no accident that the muntjac has upright spike-like antlers, the moose, broad palmate antlers that extend laterally, and the white-tailed deer, complex branching structures. In fact, Schad shows us that the subtle differences in form between the antlers of the white-tailed deer and the closely related mule deer hold significance, each indicative of the constitution of the respective animal. Similarly, we learn how to “read” the position and morphology of the great diversity of antelope horns to cultivate a sense of the nature of the living animal. Thus, horns, hooves, color pattern, body size, and even the quality of dung, when placed in context, become revelations of a dynamic, integrated whole organism in which every detail bears significance. The whole shines through every part.

The application of such phenomenological observation, which reveals otherwise hidden patterns, can be applied not just to the external morphology of mammals but also to the internal organs and even to the extra-embryonic membranes. For example, in Chapter 18 we learn that rodents (Figure 1), which in general emphasize the nervous and sensory systems, devote significant energy to the development of their extra-embryonic membranes and thus have little “surplus” energy to direct toward body development, thereby resulting in a small-bodied adult organism, which is born

in an altricial (developmentally incomplete) condition. In contrast, hoofed mammals (Figure 2), which typically emphasize the metabolic and limb systems, devote relatively little energy to development of their extra-embryonic membranes and thus have a surplus to direct toward anabolic processes, that is, toward body development, resulting in the largest-bodied terrestrial mammals. Hoofed mammals are born in a precocial (relatively developed) condition, many able to stand and even run shortly after birth. Carnivores (Figure 3), which as a group emphasize the circulatory and respiratory systems, lie between these two extremes in regard to the development of their extra-embryonic membranes, the ultimate range of adult body sizes, and the intermediate developmental conditions of newborns. Again, the whole is revealed in every part.

In conclusion, I should briefly describe my role in, and the process of, serving as scientific editor for this book. First, I acknowledge the tireless efforts of senior editor, translator, and publisher John Barnes. By the time this book rolled off the press, we had begun this project eight years earlier, soon after the publication of the new German edition (2012), and John patiently and skillfully moved the process along at a steady pace. Neither he nor I imagined initially it would take this long. After John translated a chapter, he would send it to me, and then I would carefully go over it sentence by sentence, word by word and make editorial changes. When this was completed, we emailed the chapter to Wolfgang Schad, who then also carefully went through our edits. We engaged in this iterative process repeatedly, at least four times, for every chapter.



Figure 3. The leopard (*Panthera pardus*), a carnivore, emphasizes the rhythmic (circulatory and respiratory) systems, as expressed in its intermediate body size, balanced body proportions, and rhythmic (i.e., spotted) color pattern. (Photo by MR; Maasai Mara National Reserve, Kenya)

Although we remained mostly true to the German edition, this English translation departs in some



significant ways from that publication. First, some of the chapters have been considerably expanded; Chapter 16, for example, on sloths, anteaters, and armadillos of the Americas, has been revised and extensively augmented by the author. For our English readers, potentially many from the United States and Canada, this edition also includes more information on North American species. We added statements about North American wolves, for instance, to complement the coverage of the European wolf in the German edition. In some cases, we have referred to and added more recent references, such as Lynx Edicions's *Handbook of Mammals of the World*, volumes 1-9. This collection, as well as the classic two-volume *Walker's Mammals of the World*, has been indispensable to corroborate natural history information and double-check taxonomic arrangements. Various sites on the internet, too, have been very helpful in this regard. In addition, a significant number of illustrations have been replaced with, in our view (that is, the editors' and author's), what we determined to be better images.

This two-volume compendium should appeal to a wide audience. It has been written and edited with teachers, zoologists, researchers, conservationists, philosophers of science, and students of natural history in mind. Indeed, people from many walks of life and with various academic backgrounds, who share a fascination and love of mammals, as well as a desire to engage in dynamic holistic approaches to understanding the world, will find much of interest regarding not just the life of mammals but also, for many, a reorientation to how we explore the living world.

We are so fortunate, and I am personally deeply grateful, that Wolfgang Schad has made the effort to share the fruits of his life's work in a new, expanded, updated, and accessible format. The offering is indeed rich, and there is enough between the covers of these two volumes to stimulate thought, research, and application by another generation or two. Clearly, the earlier edition has inspired research in dinosaur morphology (Lockley 1999, 2008), in the origin of autonomy in evolutionary transitions (Rosslenbroich 2014), and in a philosophical exploration of the phenomenology of wholeness (Bortoft 1998), to name just a few publications in English (there are many in German). The editors, myself included, are confident that, by engaging with this book, your understanding of the world of mammals will be forever deepened and expanded.

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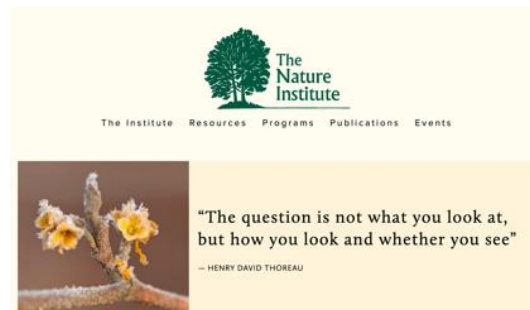
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## News

### The Nature Institute



January 2021

Dear Friends,

We'd like to share with you an [insightful interview with Craig](#) recently featured in *Acres* magazine.

Writer Leigh Glenn, who completed the [Foundation Year course in Encountering Nature](#) at The Nature Institute in 2018, asks Craig about the roots of his vocation in biology, how he came to Goethean phenomenological science, and why a practice of contextual observation matters in a world that, increasingly, focuses too much on the parts of things:

*"Context influences everything I do. It's not a static or abstract idea, but a sense of how life plays itself out dynamically in a web of relations, and those are always new and different and interesting. Living becomes very alive through that..."*

We hope your time and attention allows for a read of this thought-provoking conversation between Craig and Leigh, posted on our [website](#). Your comments or questions are always welcome at [info@natureinstitute.org](mailto:info@natureinstitute.org).

With all good wishes,  
Elaine Khosrova  
Outreach & Relations

# Calendar of Events

## From the Nature Institute

### Transformation, Polarity, and Expanding the Boundaries of Thought Through Projective Geometry

*Course with Henrike Holdrege*

**February 1-February 26, 2021**

Henrike will meet at The Nature Institute with 12 young adults participating in the year-long **M.C. Richards Program** to engage in projective geometry exercises that foster clarity of thought and imagination. Working through key concepts and major theorems, students will discover challenging and transformative ideas that can open up whole new ways of understanding.

### Model-free Physics and the Forces of Technology

*Course with Gopi Krishna Vijaya*

**March 8-March 31, 2021**

Gopi will meet at The Nature Institute with 12 young adults participating in the year-long **M.C. Richards Program** to examine assumptions behind many theories of modern physics and how to re-evaluate them in the context of phenomenology. The course will also address the nature and implications of various technologies.

### Metamorphosis, Plasticity, and Context-Sensitivity: Learning From Plants

*Course with Craig Holdrege and Nathaniel Williams*

**May 3 — May 21, 2021**

The 12 young adults participating in the year-long **M.C. Richards Program** will come to The Nature Institute each morning for three weeks to work with Craig Holdrege and Nathaniel Williams on plant study as a means of transformation and adaptation.

### **March 13-14 Memorial Colloquium for Jochen Bockemühl, Goetheanum, Dornach**

To participate or access the livestream, please register by February 28, 2021 by contacting Mara Born ([science@goetheanum.ch](mailto:science@goetheanum.ch)). Invitation and program (in German) may be found [here](#).

### **March 27 Colloquium series: the CLIMATE needs our CHANGE, online.**

Featured presentations by Susanna Kümmell and Meinhard Simon from the 2020 October conference on climate held at the Goetheanum. Information [here](#).

### **October 7-10 Evolving Science 2021, Goetheanum, Dornach**

Look for announcements in future. This will mark the 100<sup>th</sup> anniversary of the Research Institute at the Goetheanum.

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*Please consider making a financial contribution in support of our mission to bring a discerning and unique perspective on developments in science and technology to the Society's membership and out into today's culture.*

The epistemological foundation of anthroposophy is not only a matter of scientific method. Having a strong foundation in the scientific basis for a monistic science of spirit-matter is important for a healthy attitude towards conventional science today and to overcome its materialistic bias. This is important for *all* of us working with anthroposophy to further our culture today, be we teachers, farmers, doctors, therapists, artists, entrepreneurs, or anyone seeking to heal the contemporary worldview.

### Support for German-to-English translation is especially desired.

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