

Science Group of the Anthroposophical Society in Great Britain

Newsletter – March 2016

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Late issue

Apologies to members for the unusually late issue of this edition. The delay was necessary in order to accommodate late arriving copy.

News

Evolution: the third way

Under this title in *In Context*, the newsletter of the Nature Institute, NY, USA, Steve Talbott drew attention to a web site entitled *The Third Way: Evolution in the Era of Genomics and Epigenetics*, (URL: www.thethirdwayofevolution.com).

The site's rationale reads: 'The vast majority of people believe that there are only two alternative ways to explain the origins of biological diversity. One way is Creationism that depends upon intervention by a divine Creator. That is clearly unscientific because it brings an arbitrary supernatural force into the evolution process. The commonly accepted alternative is Neo-Darwinism, which is clearly naturalistic science but ignores much contemporary molecular evidence and invokes a set of unsupported assumptions about the accidental nature of hereditary variation. Neo-Darwinism ignores important rapid evolutionary processes such as symbiogenesis, horizontal DNA transfer, action of mobile DNA and epigenetic modifications. Moreover, some Neo-Darwinists have elevated Natural Selection into a unique creative force that solves all the difficult evolutionary problems without a real empirical basis. Many scientists today see the need for a deeper and more complete exploration of all aspects of the evolutionary process.'

The site gives profiles of several dozen 'researchers and authors who have, in one way or another, expressed their concerns regarding natural selection's scope and who believe that other mechanisms are essential for a comprehensive understanding of evolutionary processes', among them Steve Talbott.

WasserSpiegel

The recently launched German-language digital newsletter of the Institute for Flow Sciences is available from Eva Wohlleben at [sekretariat\(at\)stroemungsinstitut.de](mailto:sekretariat(at)stroemungsinstitut.de).

Two new papers on plant morphology/metamorphosis

In the current issue of *Elemente der Naturwissenschaft* (see page 6) are two papers in German on plant metamorphosis. Peer Schilperoord has drawn out attention to the fact that they are now available in full in English translation on the researchgate.net website and downloadable there as PDFs.

The Blossom-similarity of the Vegetative Annual Shoot of the Pedunculate Oak (*Quercus robur* L.), Kathrin Studer-Ehrensberger & Peer Schilperoord (<http://tinyurl.com/j82jpvdp>).

A new model for the archetypal plant – the perennial dicotyledonous plant, *Peer Schilperoord* (<http://tinyurl.com/z47rqbo>).

The Ronald H. Brady Online Archive

The Nature Institute is excited to announce this major new resource for the pursuit of Goethean, holistic science, which is now freely available: www.natureinstitute.org/txt/rb/index.htm

The most recent addition to the archive – *Goethe's Natural Science: Some Non-Cartesian Meditations* – is a wonderful illumination of differences between Goethean and Cartesian approaches in science.

Ron Brady, who died in 2003, was a brilliant professor of philosophy at Ramapo College in New Jersey whose extensive writings, inspired by both Goethe and Rudolf Steiner, were concerned with holistic science, evolution, and – the study of how we know what we know. Ron, a much loved colleague of The Nature Institute, was an eminently clear thinker who like almost no one else could articulate a truly holistic way of looking at the world.

We are glad to make his many out-of-print and deeply insightful articles available to the public.

Article: Creative Evolution – A Goethean Perspective

by Robert Rose is obtainable free with voluntary contribution by writing to Robert Rose at [robertrose1\(at\)hotmail.co.uk](mailto:robertrose1(at)hotmail.co.uk).

Correction:

The Dynamic Relationship of the Inner Planets

In my article under this title in the last issue I mistook the synodic and sidereal times for the Venus orbit. 5 synodic cycles of Venus take 8 earth years and 13 Venus years. One Venus year is 8/13 earth years and one Earth year is 13/8 Venus years. The ratio of these two is 64/169 which is much closer to the ratio of volumes of the respective orbital spheres than I stated in my article. (0.38) My apologies also to Johannes Kepler for getting this wrong!

Alex Murrell

Abstract

Biological evolution as the development of the archetype's manifestations

In a 53-page article in German in *Elemente der Naturwissenschaft*, Renatus Ziegler, Ruth Richter, Anet Spengler Neff and Johannes Wirz develop the Goethean type concept within the context of modern biology, evolution and development. As the paper is of general relevance to biologists and others interested in the subject we reproduce here with permission the English abstract of the paper (Ed.).

In this paper we look at biological evolution from a viewpoint that assumes concepts and ideas are structural as well as constitutive real causes. From this perspective, a biological organism is a lawful and active automorphic unit (law of inner nature) displaying a robust – i.e. stable-flexible – relation with its environment (law of outer circumstances¹). We call the lawfully acting forces inside an organism 'law of organism',

¹ See Goethe's short text entitled *Preliminary Notes for a Physiology of Plants* in: *Goethe's Botanical Writings*, Transl. Bertha Mueller, University of Hawaii Press, 1952, from *Vorarbeiten zu einer Physiologie der Pflanzen*, in Goethe, *Die Schriften zur Naturwissenschaft*, Erste Abteilung, Band 10 (Weimar: Böhlau 1964), pages 135–136.

referring to Goethe's archetype as the universal law of organismic existence.

We presuppose the concrete evidence for defined evolutionary processes and mechanisms acquired by evolutionary science under the Darwinian paradigm as facts and as a development of the manifestations of the law of organism. In each biological individual the range of the law's appearance is constrained by the history of its predecessors via heredity; at the same time within this setting we assume the law of organism to be actively present in each living being. Out of this view, a complementary evolutionary theory arises yielding the possibility of constitutive inputs of all organisms into their own development.

In part two, based on a universal law of organism, we specify general principles of development with reference to biological evolution. These are applied to common descent and the origin of species, genus and other taxonomic hierarchies.

Organismic diversity, and, accordingly, the multiplicity of appearances of the law of organism, is shaped in factual interaction of constituting instructions and modifying environmental conditions, or conditions of appearance, respectively. As exemplified in part three, concerning modification, the law of organism has the potential to react receptively to the medium of appearance by adaptation or variation. At the same time it productively operates in a constituting manner following the principles of acquisition or opening. A further differentiation of the concept of adaptation concerning the inner and outer conditional context is presented in part four by giving examples from evolutionary biology. For the sake of epistemic distinction, the simultaneously interacting processes governed by these principles are presented separately in a table. Part five deals with the degrees of freedom given to the law of organism while being constrained yet at the same time enabled by inner and outer conditions. In the context of these investigations, the genome belongs to the inner environmental conditions that the law of organism has to deal with when it self-actualises in each individual. Innovations can be realised by creative interventions which allow for the manifestation of novel principles from the universal potential of the law of organism. To attribute to the individual organism a driving force of evolution – as also some modern evolutionary biologists do – opens new explanatory ways for macroevolution.

The concept of the law of organism sheds new light on the question of purpose in evolution. From this perspective, evolution is the result of an interactive communication between the law of organism incorporated in each individual, and inner as well as outer environmental conditions. By means of opening (variation) and adaptation, the law manifests itself towards increasing perfection. This displays a lawful but not precisely determined directiveness.

The evolution of mankind as a consequence of biological evolution is addressed in part eight. In view of the fact that no further speciation is possible, the human being has arrived at the end of his *biological* evolution. Each single human organism has developed the seed of autonomy by a culmination of automorphy and autoregulation. It is not only a manifestation of the law of organism but also of a being not constrained by the limits of this law, with the potential of self-determination and self-embodiment.

from 'Biologische Evolution als Erscheinungsentwicklung'
Elemente der Naturwissenschaft 103 (2015), pp. 41-115.

Research

Collaborative Action Research Programme Morphology in the Natural Sciences

On November 6-8, 2015, The Field Centre was buzzing vibrantly with the collaborative research programme seminar *Evolving Morphological Thinking*. The specific intention of the *Evolving Morphological Thinking* seminar was to encourage collaborative research projects to emerge and develop. Towards this researchers agreed to co-present 'duets' around an area of common interest and to share the questions they are living with. This was undertaken as an experimental approach. We were delighted to be joined by Johannes Köhl and Laura Liska who accompanied and facilitated our work. Thank you to all who presented, participated and attended what was an inspiring and seed-like event.

A brief background The Collaborative Research Programme initiative began as an activity of the UK Natural Science Section and The Field Centre (Ruskin Mill Trust) in collaboration with the Science Section in Dornach. The initiative aims to encourage and foster the development of a research collegium as part of the Science Section work worldwide. The intention is to gather the diverse work of current researchers, bring it to fruition as a whole through a collaborative process, and to make it available to the scientific community as well as science-teacher education. Collaborative research projects, publications, events and conferences are some of the means envisaged towards this aim. Towards 2024 the initiative sees an opportunity and responsibility for making 2024 – the centenary of the School of Spiritual Science – a moment of precipitation, of gathering and sharing the work done over these 100 years. As such the Collaborative Research Programme will extend over a period of nine years. The Field Centre has offered to host and carry the administrative aspects of the programme for the UK Science Section for the first three years, as a pilot project for the overarching worldwide research programme.

Epistemological basis In Christiania on November 26, 1921, (GA 79) Rudolf Steiner spoke of what he termed 'morphological thinking'. Steiner characterizes morphological thinking thus:

This way of thinking is not limited to space; it lives within the medium of time, in the same way thinking lives within the medium of space. This thinking does not link up one thought with the other; it sets before the soul a kind of thought-organism. When we have a conception, an idea or a thought, we cannot pass over at will to another. Even as in the human organism we cannot pass over at will from the head to any other form, but must first pass over to the neck, then the shoulders, the thorax, etc., even as in an organism everything has a definite structure which must be considered as a whole, so the thinking which I characterized as *morphological thinking* must be inwardly mobile. As stated, it lives within the medium of time, not of space. But it is inwardly so mobile that it produces one form out of another, by constantly growing and producing an organic structure.

It is this *morphological way of thinking* which should be added to the ordinary way of thinking. It can be attained through exercises of meditation which are described in principle in some of my books. These exercises strengthen and intensify thinking. The *morphological way of thinking*, the thinking activity which takes its course in forms and pictures, enables us to reach the first stage in the knowledge of super-sensible worlds, namely the stage described in my books as imaginative knowledge.

The Collaborative Action Research Programme takes its lead from these indications from Rudolf Steiner. In doing so the initiative seeks to clarify and contextualize morphological thinking, and from this, to work to apply morphological thinking in the domain of the Natural Sciences.

Events in 2016 Following on from last November's seminar which explored the role of morphological thinking in natural science we have identified several existing fields of research activity within the Natural Science Section. These fields are: place, water, plant, animal, chemistry, and colour/light. We hope that others will also emerge in time.

This year we propose to have three workshops throughout the year. In each seminar two of the existing fields will be worked with in a collaborative action research process. If you are active within one of the identified fields we would very much like to hear from you and hope you can attend the seminars. However these workshops are also open to those not yet active but have a keen interest. The sequence of three seminars events aim to provide the opportunity for participants to work collaboratively and in a facilitated research process. A further fourth seminar will take place in November 2016 (10th -13th) which will provide a platform for research presentations and proposals. Johannes Kühl and Laura Liska would again accompany us at this meeting so connections can be made with research in other countries.

On behalf of the initiative, Simon Charter, Simon Reakes

For more information please go to our dedicated page:

www.thefieldcentre.org.uk/morphology/

Or contact Simon Reakes, The Field Centre, Tel: 01453 367 369. Mobile: 07813 234 650

Email: [simon.reakes\(at\)thefieldcentre.org.uk](mailto:simon.reakes(at)thefieldcentre.org.uk)

Meeting reports

Report on Projective Geometry meetings at the Field Centre February 2016

The first event was a workshop for those upper school teachers and others wishing to explore the fundamentals, and subsequently we deepened our understanding of space and counterspace in a seminar

The lasting impression from this time for me is one of appreciation for all that was created through the working together and between the individual contributions. In our workshop the Desargues triangle construction became ever more present and meaningful. The main contributors were Gordon Woolard and Roy Allen but it felt as if everyone was part of creating a good mutual learning event. We experienced triangular movements and choreographies of our own design in our group eurythmy. We drew constructions on paper and lived with a beautiful construction made by Gordon with thin rods. We folded tracing paper to create curves – seeing an unusual way that the conic sections form a wholeness, a single flexible idea. We tried to understand why Rudolf Steiner suggested that an understanding of the metamorphosis of the form of the head into that of the limbs was essential in order to meet the children in a class! With Eva Wohleben we made three-dimensional forms with sticks and saw how polar forms were also polar with respect to their movement possibilities. To finish the event Oliver Conradt placed the development of the geometry again into the evolution of human consciousness and spiritual and earthly events connected with the Time Spirit Michael.

In the seminar we especially appreciated the contributions from abroad. From Berlin, Charles Gunn launched the occasion by provocatively posing the question 'Do we live in the Sun?'. It was an honest account of his own experience in relation to our present isolated situation-thinking in terms of pointwise forces in the normal Euclidean idea of space, where we often deny ourselves and our experience when we wish to understand the world around us. He asked where is the soul

life actually? He still left us free to draw our own conclusions and relationship to counterspace. Charles connected again to the solar system through a later presentation around the planetary orbits as circles rather than ellipses. Oliver introduced us to line geometry and Eva took us into a great richness of flexible structures she is creating. Gordon shared his experiences with the lower senses from the "extra lesson" work he is involved with, and related this to our theme.

In a session with myself we observed the spiral vortex and ring vortex in experimental arrangements. We explored the geometry which is known of them and the possibility that they are both one metamorphosed idea, what that means for the geometry and the changing relationship within counterspace.

An important aspect of the meeting was the remembering of the immense contributions made by Nick Thomas and John Blackwood to the work. We shared a little of their biographies, special memories and their wonderful and interesting ways of being.

What was for me most encouraging was to hear the enthusiasm from those in both events to explore more realms together into the future. More such events will happen next year.

Simon Charter, 7 March 2016

Science Section Collegium at the Glashaus by the Goetheanum, March 3–6 2016

For several years Johannes Kühl has hoped for representation from the science section in England and Simon Charter and Alexander Murrell stepped into this role this year. Johannes especially wishes for a consistent commitment to the annual meeting of the Section Collegium and we both hope to carry this responsibility in the near future.

There is no insistence on linking of anthroposophical science groups with the Section at the Goetheanum, and there is no formal membership procedure for individuals to join the Science Section. The Section wants to support natural scientific work in the anthroposophical movement, and to foster links with natural scientific activity in the world, in present day cultural life. It also strives to carry the impulses of the School of Spiritual Science into natural scientific research.

A prepared theme for this year's meeting was the question of technology in connection with sub-nature and super nature, as described by Rudolf Steiner in the last of his letters to members. Colleagues from Holland have been working on a paper on this theme.

This is an important theme today because of the huge increase in the daily use of screen technology and communication devices. Also lots of groups exist who publicly lobby against the technology, and sometimes cite Rudolf Steiner for example by suggesting that electricity is a sub-natural force, and therefore evil and to be avoided.

Naturally the conversation was wide-ranging and the following is a brief and partial summary.

Electricity was discussed as a 'fallen light ether'. Light has inner qualities. For example it carries everywhere the potential for image formation. Thinking has something of the inner quality of light.

The inner nature of electricity reduces to the polarity of positive and negative. (This symmetry is of course very significant and also full of thought content when we widen the context). Light reveals space, whereas electricity connects across space,

Electricity can be made from chemistry, light, warmth and movement. It then has invisible 'potential' before revealing itself again (perhaps at long distance) in the form of light, warmth, chemical effects movements, smell etc. Electricity

comes from polarisation of charges but then it wants to disappear in the reuniting of what has been separated.

When we speak about technology in general we tend to think first about electronic technology, but a vast amount of chemical technology also stands behind modern civilisation.

Some discussion also took place about the chemical (tone or number) ether in connection with magnetism. Magnetism has a vital role in sound and voice technology through the loud-speaker. One aspect of magnetism as a 'fallen' chemical ether is its use in mass spectrometry, where chemical qualities are differentiated in a purely quantitative way.

An ether is not an object separate from our consciousness but is also a cognitive process. It is a good challenge for us to illustrate, characterise, and demonstrate the chemical ether in its transformative, rhythmic, feeling nature.

A large part of the discussion also centred on the concept of 'super-nature', the cultivation of the higher consciousness that enables mankind to be involved with technology without being pulled under by it. Developing a science not limited to the mechanical level is naturally a part of this upward balancing effort.

In representing an anthroposophical view on modern technology it will be important to give a balanced and also comprehensive overview. Psychological, educational, and life-style effects (e.g. how computer use can effect sleep life) are all important alongside the physical effects from say electromagnetic radiation.

It belongs to the mechanical scientific view to imagine a sub-natural atomic world of electromagnetic and nuclear forces which underlie our sense experiences. If we abandon this ultimately impossible kind of thinking, then our answer to the question of what lies behind the sense experiences is that this question can only mean 'how do the senses appear from the point of view of a higher consciousness'? At the same time, it belongs to a sober scientific attitude not to see the spiritual in the breaking of physical laws but the physical laws as a expression of the spiritual from within us.

The Section Collegium welcomed scientific researches from Germany and Switzerland to hear reports from several institutes. We hope in future it will be easier for interested colleagues to connect up to the different research projects going on. Research into water and a new understanding for anthroposophical biochemical techniques (drop picture method, and crystallization techniques) is happening in several places.

Questions about potentization and planetary effects are also receiving attention. A new open enquiry into these areas is proceeding alongside the 'traditional' reliance on the work of pioneers.

Work on colour spectra has been important at the Glashaus and has reached something of a culmination in the publication of the research of Matthias Rang in *Phänomenologie komplexer Spektren* (Logos Verlag Berlin). This is a most rigorous attempt to justify and extend Goethe's theory of colours. (The translation of Johannes Kühl's work on atmospheric colours into English last year was part of this project – see the review in this newsletter on page 5)

This work is doubly significant for us because two thirds of Goethe's colour theory has never been published in English, and a large cultural divide is at last being bridged. The English members expressed the wish that more of the contemporary European scientific work is translated into English on a regular basis. A modern American book was referred to: *The other Mind of Europe: Goethe as a scientist*.

As well as pursuing new research in quantum spectroscopy Matthias Rang has been working on experiments in neurophysiology. Contemporary research has shown that nervous

impulses always precede the making of an apparently free and conscious decision. The conclusion usually drawn from this is that freedom is really an illusion and the 'unconscious' nerve impulse is the causative event. In other words we are not free but determined by our brain activity! Nick Thomas also referred to these kind of experiments in his last work *Freedom Through Love*. Matthias has been proposing a series of experiments which vary the experimental conditions to widen their context. The results are so far surprising and encouraging and we hope for publication of these soon.

Microbiological work has been pursued by section members for several decades and there is also currently work going on in plant studies – the taste and smell of plants when they are treated with various metallic salts for example, and also in plant morphology.

In ordinary natural science there is a renewal of interest in morphology. Genetics may be involved in the genesis of form; it is not the form itself and it is widely known (following Stephen Jay-Gould) that developmental potentiality for metamorphosis exists independently of gradual evolutionary change, and adaptation. One botanist reminded us that Goethe's aim was morphology not phenomenology.

Another important area of work is the study of landscape and environment. This continues in Europe following the original work of Jochen Bockemühl. It is also continuing the UK in at least three regions, in Scotland with Margaret Colquhoun, the Lake District (Brantwood Estate) and in Stroud, Gloucestershire on some newly acquired land for biodynamic farming.

The Section hopes to be efficient at putting researchers in communication with each other. Both Simon Charter and I will try also to do this as co-ordinators respectively of the mathematical astronomical section and natural science section in the UK.

We also spoke about the Field Centre initiative in the UK for a collaborative science project over the next 7 years. This resonates also with the Goetheanum Michaelmas project which is aiming to work consciously towards 2024 as the fulfilment of 3 x 33 years of anthroposophical Section work in the world. Your enquires and interest in our Field Centre project are most welcome..

To conclude, here are two other reflections on the nature of science from our meeting.

Science can arise out of an individual questioning of the world phenomena. It can also be pursued as a technical challenge to improve life, for example in chemistry or medicine as well as in machine building. A third aim for science is to accomplish a change of consciousness through the need to meet insightfully our whole encompassing environment.

To bring our scientific work into an educational form can raise it to a universal human level and thus meet the needs of our time. This overcomes the isolation that results from specialization and enables the social quality of scientific activity to resonate more widely.

Alex Murrell (contact details in next item)

Meetings/Conferences

UK Group of the Natural Science Section

The Science Section for members of the School of Spiritual Science who are taking responsibility for the scientific work normally meets twice a year in autumn and spring.

The next meeting will be held on 10 – 12 June 2016 with Johannes Kühl.

The venue is to be decided. If you are interested in attending, please get in touch with Alex Murrell nearer the time.

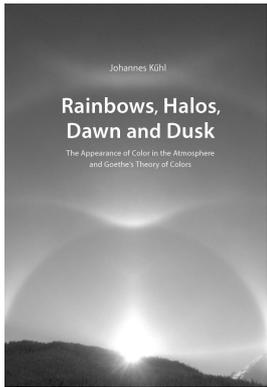
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Projective Geometry

A small group meets weekly in Brighton, currently on Mondays, to explore the laws of the space underlying physical and living forces.

Please contact Paul Courtney on 01273 557080 or 07903 961390 or at PaulRC(at)btinternet.com for further details.

Review



Rainbow, Halos, Dawn and Dusk – The appearance of colour in the atmosphere and Goethe's Theory of Colours.

By *Johannes Kühl*

Adonis Science Books, ISBN 978 – 0932776 – 48 – 8

183 pages – soft back with high quality illustrations.

www.adonispress.org

This book explores the captivating colours that appear in the atmosphere of the earth: coronas, glories,

halos, rainbows, dawn and dusk. It invites the reader to observe these ephemeral appearances with renewed attention and understanding. In addition, it introduces us to little-known key events in Goethe's life that were intimately related to his scientific pursuits and his deep experience of colour.

The text moves fluently between natural observations and suggested experiments while the photographs encapsulate the best examples of these. We can constantly relate our own experiences in nature to what is exemplified here. Anything not immediately familiar in the discussion is compensated for by the quality of the pictures and the memories of one's own atmospheric and colour impressions.

The book's aim is to be a bridge, or many coloured bow, spanning the physics of atmospheric colour and a spiritual approach to them. I believe nature observers, thinkers, and scientists will all be rewarded by the multi-faceted approach used here.

Gradually, over the first five chapters, a range of phenomena is described and ordered to give a complete survey of what Goethe called the physical colours, the colours which arise from colourless conditions. Transparent prisms, and raindrops are the most commonly known of this type of colour formation. They arise also through fine dust, misty condensation and thin films for example. Structure and geometry are the determining factors rather than intrinsic colouration. The systematic investigation of the phenomena here presented in no way diminishes one's expectation and anticipation for further experiences. On the contrary, the explicit wish is that it may be possible to "touch your eyes with the magic wand of knowing what to see".

All types of physical colour, indeed all types of colour formation known to physics, occur in the transparent life-supporting air between the illuminated earth and the darkness of space. The concept 'turbidity'—possibly unfamiliar to some audiences—is used here to define the fine and varied material elements that bring about the interaction of light and dark, and thus the subtle mediating role of the atmosphere is made clear.

It is the kind of understanding that is both intellectually satisfying and yet leaves us free to experience the phenomena on all levels of our being.

So there follows naturally a chapter on the "sensory-moral effects" of atmospheric colours, where the fullness of human experience is included in the sequence of observations. From coronas to dawn and dusk a process of integration towards wholeness parallels the range of experiences already described: knowledge and experience flow together: "In composite situations with colour phenomena like the rainbow, or dawn and dusk, the human being is integrated, part of the whole." At special moments we can even think that Nature builds her own temple around us, within us, and within the world all at once.

The book continues with a very readable overview of Goethe's Colour Theory. Important references and generous acknowledgements are made to Goethe scholars who sought to justify and uphold the scientific character of Goethe's method. A bold and clear conclusion is arrived at: the process for colour appearance as described in Goethe's theory of colours is symbolic of the process of gaining insight—the appearance of truth in the world through human thinking.

In this context, we can consider that the translation of this book into English has an extra cultural significance. Only one third of Goethe's colour theory has ever, to this day, been published in English. The translators of the Didactic part decided, back in 1837, not to publish the Polemical and Historical parts of the work. Goethe's sometimes vehement criticism of Newton's colour theory was judged irrelevant for a British audience!

Newton laid the foundations for mechanical physics and in the process divided human experience from invisible movement processes in space and time. What he called "corpuscles" of light, and today would be called electromagnetic oscillations, are supposed to constitute the real 'outer' world which stimulates our 'inner' colour perceptions. Deeper thought reveals this to be an impossible world view – and that is why Rudolf Steiner devoted so much time to its refutation while he worked to champion Goethe's original scientific approach.

A mechanical view of the world is however very useful for developing machine technology and so we see today the tremendous success of a science that bypasses the qualities of our experience for a world of measurements, movements, and forces. The scientific work here being reviewed is an example of a new kind of science aiming for conscious participation at all levels of our being, not only for explanation or technical control.

The book invites us to consider that it was Goethe's urge to defend human nature that made him "so astonishingly polemical about conventional Newtonian theory". For Goethe the whole issue of the theory of colour was inextricably bound up with a profound and fundamental understanding of the nature of human insight and its appearance in the world.

Johannes Kühl then takes a conciliatory approach showing that both conventional physics and a Goethean approach can complement each other's standpoint: "From each perspective one can learn about the other's point of view. There is something to be gained from each, to the benefit of both."

Following the notable crescendo of the previous chapters, a refreshing narrative is then woven together from Goethe's letters and poems, describing the place of the Theory of Colours in Goethe's biography. Impressed by Goethe's boldest statements and his positive confidence, many of us have long felt certain that some holistic experience must have occurred within him. Here it has been located and imaginatively reconstructed. Like all true experiences of this kind it was largely

inexpressible, except perhaps to his most intimate friends, but it later came to expression in his poetry. That such an experience was an impulse for the beginning of Goethe's scientific studies is a wonderful discovery.

A wonderful concluding chapter titled "The Earth's Atmosphere as the Natural Abode of Colour" brings together the book's achievement, and invites us to consider the meaning and mystery of our situation as colour beholders.

After this, Chapter 10 is called an appendix as it contains something for scientific specialists, rather than simply for the person who loves colour. There are indications for future research and references to new developments in colour experiments which have already become fruitful in the educational sphere. In particular, the symmetry of both the methods of Goethe and Newton, and the polarity in colour itself, can be revealed by producing both the light and dark spectra simultaneously for example in prism experiments and with colour mixing. Traditional school experiments are certainly enhanced by this. I am sure that Goethe would have smiled to see these technical extensions and illustrations of his work.

Goethe's poem "Dedication" rounds off the book, in a fine 1851 translation. Perhaps our understanding of this beautiful piece of writing has been widened through knowing its biographical context. The feeling is that we have come closer to Goethe, even as we appreciate the vista into the future inspired by the new relationship to Nature which he pioneered.

I found this book to be a useful handbook for accompanying ongoing participation in the special events of atmospheric colour appearance, a stimulus for deepening a contemplative approach to these experiences, and indeed part of that profound work towards wholeness in science.

Alex Murrell

Publications

In Context, The Newsletter of the Nature Institute

No. 34 Autumn 2015: Amazonian Impress, *Henrike Holdrege*. Portraying Soils and Compost: Colour, Form, and Pattern, *Bruno Follador*. Is a Science of Beings Possible? *Craig Holdrege*. DNA and the Whole Organism, *Stephen L. Talbott*.

Editor: Steve Talbott. Single copies of *In Context* are available free of charge while the supply lasts. Contact details: The Nature Institute, 20 May Hill Road, Ghent, NY 12075. Tel: +1 518 672-0116. Fax: +1 518 672 4270. Email: info@natureinstitute.org. Web: <http://natureinstitute.org>. The Nature Institute's online *NetFuture* newsletter is available at <http://netfuture.org>.

Elemente der Naturwissenschaft

No. 103, 2015: Blütenhaftes in der Metamorphose der vegetativen Jahreszuwachseinheit der Steil-Eiche (*Quercus robur* L.), *Kathrin Studer-Ehrensberger & Peer Schilperoord*. Ein neues Modell für die Urpflanze – die mehrjährige Blütenpflanze, *Peer Schilperoord*. Biologische Evolution als Erscheinungsentwicklung, *Renatus Ziegler, Ruth Richter, Anet Spengler Neff, Johannes Wirz*. Als die Fische gehen lernten, *Johannes Wirz & Ruth Richter*.

Editorial board: Ruth Richter (editor-in-chief), Johannes Wirz, Johannes Kühl, Mara Born.

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Cost: Annual subscription (2 issues, including postage): €30.- / CHF 40.-. Single issues: €18.- / CHF 25.- ISSN 0422-9630.

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Mathematisch-Physikalisch Korrespondenz

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