



Goetheanum Research Institute

Natural Science Section

Section for Agriculture

2013 Annual Report



Goetheanum

2013 Annual Report

Goetheanum Research Institute

Editorial

Dear Readers,

We are pleased to invite you to leaf through our 2013 Annual Report to learn about the many projects and activities at our Institute.

Goethean and anthroposophically oriented basic research is the framework in which we work on the various projects. As always, the range is wide. Among the basic research projects we can include inheritance of acquired characteristics, colour change in the cycle of the year, and rhythmic shape changes in mistletoe berries and deciduous tree buds. Also included is our research on plants fertilised with metal salts, and our ambitious project on emission and absorption processes.

Our applied research in 2013 comprised the bee project, seeds of medicinal plants, and portraits of plants used in medicines and cosmetics manufacture at Weleda AG.

We also continued the project 'Understanding Quantum Physics', which is engaged with interpreting quantum physics and developing suggestions for physics teaching in the upper school (Waldorf-Steiner).

We are increasingly involved in general anthroposophical training activities at the Goetheanum. Thus almost all our colleagues participate in student courses and text studies. We so often experience how enriching this work is – teaching and research really do belong together. Nevertheless, the amount of time this takes on top of research projects and other events sometimes takes us to the limits of our endurance. The collaboration between the Agriculture Section and the otherwise more natural science orientated Institute is also largely focused on training and continuing education.

We would particularly like to draw your attention to the conference we are planning for October 2014. The Glashaus where we work will be 100 years old this year. We would like to use this occasion to invite colleagues from all over the world to join us in taking a look at anthroposophical natural scientific work (see p. 34). How should we shape the future of Goethean and anthroposophical work in relation to societal requirements, current scientific research, and anthroposophy as a spiritual science and spiritual practice?

Our finances continue to be a concern although the greater part of our work is funded by donors, foundations, and companies. More details of this can be found at the end of the report.

We should like warmly to thank all those who have supported our work, whether financially or in spirit. Without your interest, our Institute would not exist in its present form. And, dear readers, we hope that you will find something that interests you in the following pages.

Johannes Kühl & Johannes Wirz



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Part I.

Current research projects

Hope for the bees? The project's second year

Johannes Wirz

Do mistletoe and Echinacea extracts added to the feed given to bees improve the health of their colonies? The answer to this question was sought in the project's second year. For various reasons only three beekeepers continued to participate. Nevertheless there were two groups of experimental bees ? 53 'old colonies' plus 12 'young colonies' that were newly created. Both groups had four variants: the first received both extracts, the second and third either one or the other, and the fourth was the control with no extract.

There were two surprising results which, though not yet statistically verifiable, appeared to justify a continuation of the project. With the young colonies there were no losses after wintering. With the old colonies, those with both extracts suffered 20% losses. In the two groups receiving only one of the extracts losses were 31%, and in the controls it was 35%. We may cautiously conclude that having both extracts in the feed produced a positive effect on wintering.

The second result is somewhat puzzling and more exciting. What in the first experimental year had to be assigned to 'chance', namely that the colonies with extracts in their feed showed lower mite numbers, was confirmed in the second year. At three of the five apiaries, in the extract colonies the number of mites was noticeably lower than in the control colonies. What causes this effect is an open question. Is it attributable to



Johannes Wirz holds a swarm of bees together with the branch on which it settled on a tree in the grounds of the Goetheanum.

a strengthening of the bees? Have the extracts an inhibitory effect on the development of mites, or is the bees' hygienic behaviour stimulated in the extract colonies? Before these hypotheses can be tested, the effect on the reduction of mite numbers must be unequivocally demonstrated. Here again, a continuation of the project is justified!

The exoteric/esoteric dichotomy in research

Renatus Derbidge

The research project entitled ‘Rhythmic shape-changes in mistletoe berries dependent upon moon-zodiac constellations’, which will be concluded during the coming year, brought with it in 2013 the task of delving into its origins. The method I am applying, namely projecting lambda, a shape parameter from path-curve geometry, onto the living forms of mistletoe berries and tree buds, has a long tradition.

First and foremost in research into the various path curves that correspond to many kinds of buds was Lawrence Edwards, a Scot who worked on it for at least 50 years until his death at the age of 91 in 2004. In his fundamental work *The Vortex of Life* he left us his legacy detailing his methods and their application to not only buds but also the human heart. In September 2013, I travelled to Strontian in the Scottish highlands where Edwards lived and worked in the last decades of his life. Aidan, one of his five sons, received me and one afternoon I met Edwards’ widow Barbara. Before greeting one another, even before looking at me, she took up a piece of paper on which was written the old Rosicrucian verse that Steiner had incorporated in the Foundation Stone Meditation, turned to me and said: ‘Please explain these words to me’. She had arranged for part of the verse to be written on her husband’s gravestone and had forgotten what they mean. After a long discussion about it she became so tired that I departed hardly any the wiser about the life of Edwards. However, this experience gave a direct impression of the context in which Lawrence Edwards had carried out his work.

Our work at the Goetheanum Research Institute has many aspects. The above story conveys a little of the challenging environment in which we work here. We aspire to working scientifically. Although it was possible to publish the first paper on my project in the renowned online journal *Plos One* (see Publications on p. 46), it cannot be taken for granted that we, in our small way, can join in the great circus that is science. Our small budgets, our lack of supporting working communities – I worked, like the rest of



Left: Landscape and vegetation in Strontian (Scotland). Right: Lawrence Edwards' home.

us, almost entirely alone, although I had fruitful collaboration on some issues as well as helpful support from the Witten-Herdecke University and Hiscia, the Association for Cancer Research in Arlesheim – sometimes reduce that aspiration to the level of farce.

Epigenetics of *Senecio vulgaris* L. (Asteraceae)

João Felipe G. Toni

The aim of the project is to investigate possible heritable phenotypic modifications induced by environmental stress in the common groundsel. I have been looking only at the phenotypic level, more particularly its morphology.

Senecio vulgaris L. is an autogamous annual plant with a short life cycle of approximately 8 weeks. The experiment was carried out between the end of May and the end of

August 2012, and designed in two sets: first, a propagation of the 8th generation under stress conditions, followed later by a test under relaxed conditions.

During the propagation period the seeds of the 8th generation were germinated on composted soil and transplanted after 2 weeks into small pots (5 x 4 x 10cm). A total of 60 plants were propagated and distributed amongst four treatments (water stress, drought stress, salt-water stress and salt-drought) and a control, each group containing 12 plants. A test experiment under unstressed conditions under half-shadow was carried out from the beginning of June 2013 and September 2013. A similar test was carried out with the 9th generation, but this time under full sunlight (around 10h per day).

In both experiments there were no visible heritable phenotypic modifications but a significant variation within the treatments. In trying to interpret these results, the first idea that came to my mind was related to one presupposition that I took for granted, namely that *Senecio vulgaris* is apomictic. But according to some authors (e.g, Kadereit 1984) *S. vulgaris* is self-pollinated. Since we learn at school that there is crossing-over in meiosis, including meiosis in self-pollinated plants, we are thus lead to believe that there will be also genetic sequence variation in *Senecio*. So maybe *S. vulgaris* is not the right plant for this experiment!

However, looking closer at other findings in the epigenetic research, we discover that this is not the main problem, and for three reasons: firstly inherited effects of parental environments on offspring phenotypes are often found also in outcrossing and self-pollinating species, i.e. this is not restricted to apomicts. If we do a literature search on ‘maternal effects’ then we will find many examples. The underlying processes are usually not investigated. Epigenetic mechanisms such as DNA methylation are a potential candidate mechanism, but there are many other possible mechanisms.

Secondly, the expression of heritable phenotypic modifications can be quite context-dependent. For instance, in the research of Verhoeven and co-workers with *Taraxacum officinale*, they found phenotypic effects in some cases but not in other cases.

Thirdly, things can also depend on our experimental design. For instance, how were seeds selected during the 8-generation exposure period? If a population of plants was exposed for 8 generations to drought, and there is genetic variation between plants, is



Right: 9th generation of *Senecio vulgaris* grown in full light and without stress after 8 generations cultivated under salt-water stress conditions. Left: Control, i.e. *S. vulgaris* cultivated in its 9th generation without stress conditions.

there a possibility that there has been selection for drought-resistant phenotypes? This may interfere with evaluation of environment-induced and inherited effects.

Concerning the heritability of epigenetic marks, it is possible that apomixis permits more stable inheritance of epigenetic modifications than outcrossing or self-pollinating (because epigenetic resetting mechanisms may be circumvented if we don't have meiosis). But not much is known about epigenetic resetting in plants. Most evidence today suggests that many DNA methylation marks pass through meiosis in a very stable way, so maybe it does not matter much if *Senecio vulgaris* is apomictic or sexual.

The question still remains: why is the phenotype of plants from the four groups under different stress conditions so conspicuously different? And for what reasons is the phenotype under relaxed conditions – even if the ancestors have been stressed for eight generations among these groups so indistinguishable? For a next step it will be worth looking for heritable epigenetic marks through the lens of molecular analysis.



Hortus officinarum

Biodynamic seeds for medicinal plants

Ruth Richter

The initiative for the foundation of the Hortus Officinarum Association arose from the biodynamic movement. In the medium term it aims to further the work in the medicinal plant sector of breeding initiatives such as Sativa AG and Peter Kunz's work on cereals. The Association supports the maintenance and breeding of medicinal plant lines that have been tried and tested in the manufacture of anthroposophical medicines, or that have been recently taken into cultivation. In the five years since its founding, the co-workers of the association have documented and thrice propagated lines of at least thirty medicinal plant species. Thus a line fulfils the conditions for being given the Hortus label that guarantees its biodynamic provenance and the unbroken 'biography' of the seed. Little-used medicinal plant species such as annual nettle or scarlet pimpernel, for which there is no organic quality seed on the market, are propagated by Hortus. Seed that is not used by partners in the network is made available to a wider circle of customers through the Sativa catalogue. With some species we have started on the selection for characteristics that are required by the partner organisations.



In the Middle Ages, medicinal plants were cultivated in monastery gardens. As with cereals, vegetables and fruit trees, their diversity was developed over hundreds of years. The maintenance of cultivated plant diversity is important for our daily life – no plant breeding means no culture. To protect seed resources, the plants must be in continuous cultivation so that they can adapt to the changing environmental conditions. And they must be further developed through breeding in order to satisfy the requirements of mankind today.

This work is a cultural activity that contributes to the common good, and therefore needs public support. The aim of Hortus Officinarum, a charitable association, is to participate with other breeding initiatives on applying sustainable agriculture in the field of medicinal plants.

Co-workers: Ruth Richter, Andreas Ellenberger & Tanja Paeslack

Anthroposophical rationale of medicinal and cosmetic plants

Torsten Arncken

At the present time, I am working at the Research Institute in two subject areas. One is applied research for Weleda Cosmetics and the other is basic research on the effect of metals on plants.

In 2013, in collaboration with Dr. Leo Zängerle of the research and development department at Weleda Cosmetics, various plants were studied that are to be used in cosmetics. This work was to develop an anthroposophical rationale for the effect of these plants. The starting point for this is the phenomenology of their shape, aroma, and taste in connection with their environment and with the season in which they grow. From this we develop links to their effects on the human being, particularly on the skin. Especially successful was the work on marsh mallow which has been incorporated into the new 'White Mallow' cosmetics range.

In my basic research, I am looking at the effect of metal fertilisers on plants. The first experiment in this project involved fertilising plants with all seven 'planetary metals' and growing them at the same time side by side. This allowed the seven qualities to be observed phenomenologically. The result was that all the qualities were clearly distinguishable from one another.

The plants transform the ponderable metal salts into imponderable shape, aroma and taste impressions. Many of the experiences are at first different from theoretical expectations, but it is possible to categorise them in relation to what is known about planetary qualities. This extended existing knowledge of the planets through concrete sensorial impressions and possibilities of sensory-moral experiences. Thus these experiences point a way to more intimate knowledge of the planets that, from a starting point of exact sensorial perception, can lead to an inner deepening and encountering the planetary beings.



Melissa, fertilised with different metal salts:

Controll Ag Cu Hg Au Fe Sn Pb

Here is an example: gold has a strong aura and one might expect that fertilising with gold would lead to a particularly pleasant aroma. In fact the plants treated with gold become particularly large and develop a harmonious form. But their aroma decreases and becomes generally plant-like, i.e. fresh and grassy.

I am involved in workgroups with doctors who are studying this and other topics in anthroposophical medicine. The topic in one of these groups is the dependence of the mineral content on the medicinal plant species. Here we work with nettle and have tried the recipe developed by Dr. Cloos, and observed what happens at the individual stages as well as how these change. In this context, my job is always to represent the plant anew and, through guided observation, establish contact with the plant's essential being. Another workgroup is concerned with plants fertilised with metals. In preparing the fertilisers we refer to 17th century alchemical texts which Rudolf Steiner had in his library.

Overall my work can be characterised as developing a holistic approach, not only to the plants but also to mineral substances. For this I use systematic artistic techniques and meditation in order to extend the purely intellectual science to involve the whole human being in the research process. In this kind of research the spiritual and religious dimension is linked in an exact scientific procedure to the natural phenomena.

The Falling Leaves Project

Seasons, Senescence & Color Theory

Laura Liska

«I believe a leaf of grass is no less than the journey work of the stars.» – Walt Whitman

The dramatic and enigmatic colors of autumn – those appearing during the process known as «senescence» – provide a beautiful yet complex phenomenon which invites one to consider deeper mysteries within the cycle of seasons. Each landscape, each tree, every leaf has a unique pattern of color change. Researchers have documented the influence of environmental factors on these patterns. They confess, however, that they have not reached any conclusion as to the meaning of the particular colors, or why, from a biological, ecological or even evolutionary standpoint, there is a color change at all.

Inquiry

My scientific interest thus becomes two-fold: What is the empirical nature of color change through the seasons? What is the significance of the sensory experience to the human being participating in it? Put another way – what is Nature doing with these colors and, by these colors, what is she doing with us? How can one study light and darkness in the color-producing growth-and-decay process of plants in such a way as to help raise what was merely unconscious participation in seasonal rhythms to conscious awareness?

The Project

The Goethean scientific method is perfectly suited to my questions because it connects scientific inquiry with spiritual inquiry; the phenomena in nature with the human soul and spirit. Intrinsic to this way of science is the methodology which I use: focusing



initially on empirical phenomenon, then experimental phenomena, and finally pure, or archetypal, phenomenon. I have followed – as a format for structuring my inquiry – the sequence of chapters in Goethe’s Theory of Color. This begins with exploring the nature of color in different manifestations: physiological, physical, and chemical. Once conditions for the appearance of color are understood, a deeper understanding of the relationship between the colors themselves is sought. This is followed by considering the relevance of the inquiry to other fields of interest and, finally, by elaborating the «sensory moral» aspect of color.

As such, the first year of this project (2012/2013) focused on familiarization with rhythms and patterns of seasonal color through extensive observation and documentation around the Goetheanum, the surrounding Dornach landscape and the valley of Lauterbrunnen. The second year (2013/2014) will deepen this work through continued observation, study of scientific literature, and experimentation with certain aspects of the phenomenon. For example, experiments will be conducted to study color constancy – how human vision «adapts» to changing color. An analysis of «chemical» color will be attempted through chromatography of leaf pigmentation. In addition, Goethe’s fundamental concept of «polarity and enhancement» as it may apply to photosynthesis and senescence will be explored.

«To feel the supreme and moving beauty of the spectacle to which Nature invites her ephemeral guests! ... that is what I call prayer.» – Claude Debussy

Understanding quantum physics

Johannes Kühl

This project involves using Rudolf Steiner's theory of knowledge to investigate how the various 'curiosities' of quantum physics can be appropriately grasped and in what way they can be introduced into the Waldorf-Steiner school curriculum. The work proceeds not only at the theoretical level but also through experimentation.

A high point was the preparation and presentation of a workshop at Witten-Herdecke University in August at the invitation of Prof. Wolfgang Schad. We had invited to it Prof. Eberhard Müller, a physicist who a few years ago had published material on the question of the interpretation of quantum physics, and with whom we were able freely to discuss a number of issues. In many respects that weekend was very helpful for our project, especially as it enabled us to crystallise out the questions that we ourselves have to work on, and show how important it is to examine the matter not only from the viewpoint of physics but also from that of chemistry. For example, so-called covalent or electron-pair bonds are only 'explainable' by physics. This makes it clear that quantum physical relationships are of crucial significance for the material basis of all life processes. That is easy to overlook. Therefore, studying this type of bond, and its associated matter of understanding electron spin, is an important part of the project's work.

Furthermore, at the invitation of the Nature Institute in Harlemville (USA, NY) a colloquium was held for specialists and teachers interested in this field. Finally, a workshop on this topic was prepared for 2014 in Dornach for physicists and physics teachers. Even though the main aim of this project is not a historical study, there is nevertheless the recurring temptation to investigate in more detail the extraordinarily interesting development of quantum physics. In connection with the centenary of the Bohr atomic model, a publication has been produced under the title *Denken an der Grenze*.

Emission and absorption phenomena

A supplementary project to ‘Understanding quantum physics’

Matthias Rang & Johannes Kühl

The discrete line spectrum of a gas discharge at very low gas pressures is a particularly easy quantum phenomenon to set up. This phenomenon was one of the most important observations that led to the formulation of quantum physics. The aim of this supplementary project is to carry out a suitable experiment in which the gas discharge varies over a wide range and thus the phenomenon itself can be changed.

Varying the conditions for characterising the circumstances for the phenomenon

Among other things, the Goethean approach involves not only an exact study of the details but also always an attempt to pay attention to the whole. To take an example from living nature used by Bockemühl and others: leaf series show not only the details of the leaves but also the inner transformational process of the plant, and thus enable the inner relationship with other plant species to be understood.

In contrast to this, the phenomena of inorganic nature seem isolated, as they do not have the growth process or inner development. Therefore, to be able to connect them with other phenomena, the experimenter has to develop experimental series that enable a phenomenon to be transformed into neighbouring phenomena in order to first make visible the inner relationship. The experimenter so to speak lends to the phenomena what organic nature carries out for itself during development.

Therefore, considered in this way, one inorganic phenomenon in an experiment, even if fully described by all the senses, is not yet a ‘whole’, for, through its (arbitrarily) set conditions within nature itself, it is static and isolated; the whole is only recognisable

in it through its various transformational forms (and may have some relation to what Goethe called the 'primal phenomenon').

Transformational forms

In our case the difficulty arises that wide areas of inorganic nature have to be covered in which the parameters of the phenomenon are continuously varied. This is only achievable with a high investment in equipment. Only then does the gas discharge phenomenon change fundamentally. From a broadly extended, but only weakly glowing blue-violet and even transparent gas cloud, arises a very small light phenomenon only a few millimeters wide. In other words, a brightly gleaming colourless and totally opaque arc of light appears.

But interestingly, this change in spatial concentration is connected with a contrary change in the spectra of the light phenomenon: with the spatial concentration is connected a spectral spreading in the form of a continuous spectrum from ultraviolet through the visible into infra red light and further to heat radiation. In contrast, spatial spreading of the light phenomenon is connected with a spectral concentration or discretising. Certain areas disappear from the continuous spectrum and band spectra appear. And by further spatial spreading we arrive at the characteristic line spectrum for the gas which comprises only a few but very bright individual totally separated and sharp spectral lines.

In the present case, this contrary transformation can be expressed as follows: the condition of spectral concentration in a volume of luminous gas is its rarefaction, and vice versa. There is already in this characterisation of purely classically observable variables a connection that is just like what is also typical for quantum mechanical variables (which were not directly discussed here).

Part II.

Teaching and events

Focus on the honey bee colony – the beekeeping course at the Glashaus

Johannes Wirz

Every year since 2009, up to thirty people have gathered on six Saturdays in the Glashaus' west cupola to gain their first experience of bee-appropriate beekeeping. Each course day begins with a vivid and professional introduction. In the afternoon the participants observe the opened bee colonies with the course leaders Sibylle Probst, Martin Dettli, Hugo Löffel and Johannes Wirz. Although the group is very mixed, the work proceeds smoothly – amazing considering the range, from experts with decades of experience to people having their first contact with bees. Working together like bees in a hive! The course is enlivened in several ways: in the introduction it is through powerful and living images. What does the colony or the Bien look like as a whole? It is spherical like a ball. We can see this shape in the swarm and in the construction and organisation of the brood nest. How big is a bee colony? It depends on the time of year. In the winter the cluster is a sphere about the size of a football. But in the summer it extends its 'limbs' for kilometres into the surrounding landscape – a giant among animals.

In the second part of the course are Rudolf Steiner's bee lectures. During discussions, the participants experience how familiar he was with the life of the bee as a non-beekeeper when he refers to the swarm as a death process and natural comb as the skeleton, or considers the problem of artificial queen breeding and the capacity of colonies to compensate for unfavourable conditions.

In the afternoons, at the open hives, we are able to follow the bee seasons. We can see how the brood nest grows as the days approach 21 June, and thereafter shrinks



once again. Each person can look at the small white eggs, the larvae in various stages of development, the capped brood cells, in which the metamorphosis to the adult bee takes place, and we often see young bees hatching. We run swarms into the hives and follow the dynamics of comb construction with its snow-white wax. At midsummer we observe the mites and learn how to get rid of them with formic acid or oxalic acid. Extracting honey, melting wax and an introduction to the healthy bee products add to the picture. Finally, the winter stores are estimated and, if necessary, supplemented with a feed of sugar, herb tea and honey. At the first cold weather, the hives should have between 18 and 20 kg stores which should be carefully packed in the combs and covered with an airtight and waterproof capping.

Landscape observation and other observation exercises round-off the course activities. By the final course day many have decided that in the following year they will keep bees themselves, observe them, and look after them with respect and love.

Under discussion ... outreach work and Section work

Travel – international Section activity

Johannes Kühl

In 2013, the public activities of the Institute's co-workers primarily comprised the many lectures and seminars of Johannes Wirz as well as a few trips by Johannes Kühl.

I gave a weekend seminar on gold and its colours at Ruskin Mill (England). That resulted in me being there again in September for the opening of its 'The Field Centre', a building for scientific work.

In April I revisited Brazil and gave a course on colours to a teacher seminar in São Paulo. In addition there were lectures in Recife and São Paulo where I also took part in a seminar on meditation. Michael Mösch had prepared and organised everything perfectly.

In the summer I was able to attend a conference of a group of the Optical Society of America on 'Light and colour in nature' at Fairbanks in Alaska. That was a most enjoyable experience, because I was able to meet personally many of the people I had got to know over the Internet through work on the book *Höfe – Regenbögen – Dämmerung*. After this I had a brief stay in Vancouver, giving two lectures. I thank Steven Roboz for the preparations there.

I was again in the USA in November, this time at the conference of the group of the Natural Science Section there, which took place at the Nature Institute in Harlemville (NY) and involved giving a class lesson, a lecture, and a seminar on quantum physics. After that came a course on colour at the Spring Valley Eurythmy School (NY). Then I went to Boston to give a lecture, where I very briefly encountered the 'cultural heart' of North America, the homes of Emerson and Thoreau. Finally I was invited to a branch of the Anthroposophical Society in Toronto. Most impressively it is an incredibly lively branch with all sorts of activities. This journey was rounded off by a visit to the Niagara Falls, sadly all too brief.



Physicists workshop in 2013 at the Glashaus.

Under discussion ... politics and science

Symposium on beekeeping at Fischermühle

As well as arranging our own conferences, we like to contribute to various specialist conferences in this country and abroad. Johannes Wirz reports here on a science symposium on the problems of beekeeping in a predominantly conventionally farmed landscape.

After much wavering, the EU Commission has banned the use of four neonicotinoid pesticides for two years from 2014. These are nerve poisons with long-term activity and affect both pests and beneficial insects alike. Many will remember the massive deaths of bees on the plain of the Rhine. But what happens when insects are not exposed to

lethal doses of this pesticide? This question was discussed in a scientific symposium on 16 and 17 September 2013 at the teaching and research apiary Fischermühle Rosenfeld in Germany. Carmen Diessner and Thomas Radetzki of Mellifera e.V. organised the event. The invitation to the symposium went to representatives of all affected groups: beekeepers, non-governmental organisations, the German Beekeepers' Association, the German Commercial Beekeepers' Association, Bioland, the German Ministry of Food, Agriculture and Consumer Protection (BMELV), all bee research institutes in Germany and the agrochemical industry.

Under the skilled moderation of Prof. Randolph Menzel (Free University Berlin) the topic was thoroughly and controversially discussed. The result was sobering. In individual bees, disturbances of the orientation behaviour and communication in the hive can be demonstrated. Furthermore other experiments showed a reduced life span of marked insects. Yet the negative effects were not reflected at the colony level! Representatives of the agrochemical industry saw the harmlessness of the pesticide confirmed and criticised the EU ban. However, the matter is not that simple. It is known that in summer a colony loses 500 bees a day through natural causes – and these are replaced by young bees. The so-called mass turnover is enormous. It is highly likely that a rise in the number bees departing because of neonicotinoid damage simply remains undetected in the general turnover. We urgently need long-term experiments to observe colonies over one or two seasons. Besides investigations of individual bees, we need studies on whole colonies. The bee population, the brood turnover, and comb building activity are a few of several properties that allow assessment of colony vitality. Together with colleagues, we should like to find out if there exists the political will, i.e. sufficient funding, for such a project, ideally in collaboration with representatives of the organisations and institutions present at the symposium.

2013 Summer University

Renatus Derbidge

Each year we plan it, look forward to it and carry it out. In the meantime it has become a trial. Or perhaps not? To some extent each year it stimulates us to doing something new, as well as giving us some anxious moments. Will it work? Is the idea still relevant? Who are the target audience?

The idea of the summer university, and thus its name, was originally a deepening of Goethean science as a broadening and furtherance of a person's existing involvement in science. It was thus conceived as a course for students to attend during or after their studies. This original vision needs to be adapted to new circumstances: today's Europe-wide Bologna system no longer allows students enough free time to follow their own interests. Increasingly, quite different people attend the summer university, for example, those taking a new career direction, artists, retirees, plant enthusiasts or just people interested in anthroposophy who are looking for a way via this course to the Goetheanum. The decrease in participants and their increasing heterogeneity was becoming a challenge. Some of us struggle to adapt to the demand with something like an introductory course. Others think we must bring it to the level of a college of continuing education ('Volkshochschule'), i.e. it should be for adults and not a university. We wrestle with this and discuss it. But ultimately pragmatism wins and a program, not overly different from the previous year, is very lovingly and optimistically prepared. A week in the Glashaus: fundamentals, diversity, more explanation of method, giving an overview; the second week in Lötschental for individual study through practical work on a small project of the student's own choosing.

In retrospect it is always surprising and cheering that it works, despite all our thinking about it. The participants give varied and constructive feedback that encourages us to do it again. Indeed, feedback actually says: 'stop doubting, it's good what you are doing'. The demands of being scientific, exploring methods, and the absolute requirement to attain real experience and learning for each participant, seems to have succeeded –



A 2013 summer university participant sits in the collapsed mouth of 'Lang glacier' in Lötschental.

the diversity of presenters enriching. Indeed, it is precisely the cooperation between different approaches that is appreciated. The summer university is a time in which, regardless of our usual assignments, nearly all the staff work together on one project.

The 2013 summer university took place between 29 July and 10 August, this year wholly in English. In the first week the presenters were Barbara Derbidge (eurythmy), Renatus Derbidge (landscape aesthetics, zoology), Johannes Köhl (inorganic nature, text study), Matthias Rang (colour), Ruth Richter (metamorphosis, plants), and Johannes Wirz (organic nature, animals, human being, and meditative study). The second week in the Alps was led by Barbara Derbidge (open air eurythmy, cooking), Renatus Derbidge (projects on geology, geomorphology and botany), Matthias Rang (projects on the history and culture of the valley), Ruth Richter (botany) who also supplied our kitchen, and Johannes Wirz (projects on insects, exercises).

The next summer university – again in English – will take place between 4 and 16 August 2014. The focus will be on an extended view of the living world using scientific and artistic approaches. In the first week we will concentrate on the Goethean method and how we can learn about it through thinking and experiencing. The sec-



Project work in the second week of the summer university. Left: a participant sketches a rock on the far side of the valley (and a participant's imitation of one in the foreground). Right: Presentation of project results on the last day.

ond week offers an opportunity to carry out small projects in the alpine countryside. Thus, as we learn from participant feedback, the summer university now has two aims: learning (about the Goetheanum and anthroposophy through sound Goetheanism) and experience (of nature, love of the sense world and gathering one's own experiences in research). It should not be necessary to say that besides all other aspects it also has a social element, above all a summer festival.

The meaning of experiments for Hobbes, Boyle and Goethe

Ruth Richter

In the 17th century, the natural philosopher Thomas Hobbes and the researcher Robert Boyle argued on the issue of whether it is possible to obtain true and valid knowledge about nature by experimentation. Hobbes held the view that judging the credibility of experimentally produced phenomena was conditioned by political and social values, whereas Boyle thought the truth of an experimentally mediated fact needed no judgement but instead confirmation by eye-witnesses. What Boyle did in his laboratory became fact through being witnessed.

Four hundred years later we realise that Boyle's trust in the experimental method had grasped one aspect of reality. It enabled the development of a gigantic network of knowledge which brought humanity huge progress in its emancipation from nature. Hobbes' question about the political relevance of scientific results was swept away. Knowledge, the mother of action, allows a world to arise in which people work to take into their own hands even the creation of new life. When all properties of living matter have been resolved to their elementary parts and are known, then organisms with desired features can be newly assembled like building blocks.

The metaphors that this growing branch of science – synthetic biology – uses to describe itself not only shape the current research agenda, but also our convictions and values – and thus our future. When the discussion about design extends from clothes, cars and buildings to living organisms, distinguishing between 'artificial' and 'natural' becomes problematic. Familiar humanist ideals such as the dignity of creation, become questionable. Here we need to agree on how we want mankind to live in the future. Isn't this resurrecting Hobbes' cause in a new guise?

Goethe's scientific method, developed 150 years after the Hobbes-Boyle argument, unites aspects of the views of both sides. Like Boyle, he too saw the validity of experiments for obtaining knowledge about natural objects. But out of respect for the object

being studied, the scientist has to develop the measure of judgement not out of himself but out of a large range of experiments that enable the objects, under various conditions, to speak for themselves. At the same time Goethe demanded that in science each experimentally produced hypothesis be made public because only through the joint efforts of many can knowledge be raised to a new level. When Goethe proposed that, while putting together a scientific structure, the planning and materials of the experimental process should be assessed by all participating in the undertaking, he adopted Hobbes' proposal for a public decision on the conditions for proof of the experiment.

The respect for nature included in Goethe's method is not exhausted by the setting-up of ethical commissions. It plays a part in everyday science at each evaluation of an experiment. Knowledge about an object can raise its claim to validity only when we are fully aware of the conditions out of which it originates and into which it acts. If this kind of understanding were mandatory, then the transfer into practice of scientific findings would be significantly slower. This would avoid continuing to use the earth and its atmosphere as a vast research laboratory and would give people more time in the breathtaking speed of progress to think again about issues arising out of science. In this respect, Goethe's method for studying nature carried the potential for new and highly relevant research programmes.

Section for Agriculture

Jean-Michel Florin

Our main annual conference which takes place each February is an important event for the Section and for the whole biodynamic movement worldwide. The Agriculture Conference is attended by people from all five continents and more than 30 countries. This conference represents a high point in our year's work in which a theme is studied in depth and participative methods practised. At the 2011 conference we introduced dialogue and participative methods with the help of Claus Otto Scharmer and Nicanor Perlas. We now aim to train more people each year in these methods. Accordingly we worked intensively on them for a week in January 2013. Parts of this work are adopted by many events in the biodynamic movement. The methods used accommodate the need to understand biodynamics not only as a tried and tested tradition, but also as a future agriculture with which the human 'I' can connect.

After three years of conferences in which the theme was the social aspect, this year we chose a very topical agricultural theme, namely Bees ? *Creators of Relationships*. The 2014 conference was not intended as an event for specialists, but rather for focusing on the relationship between bees and mankind and nature, in order to help us understand the many facets of these relationships. On the one hand, the thematic emphasis was on biodynamic practice, and on the other hand, as the subtitle *Creators of Relationships* suggests, we intended to continue the work on the social aspect. For this we had organised a workshop in the autumn of 2013 for training the moderators. A further aspect of the work was the development of 'inner certainty'. How can we enliven our inner work in such a way that we carry out our everyday biodynamic work less according to recipes and instead raise learned knowledge to the level of intuitive knowledge? We should like to strengthen this aspect.

In connection with this main part of the work we have developed a number of new projects, of which two examples follow:



- Documentation *Agrikultur für die Zukunft ? 90 Jahre Landwirtschaftlicher Kurs Koberwitz* (Agriculture for the future ? 90 years of the Agriculture Course at Koberwitz). In 2014, anthroposophically inspired agriculture has its 90th birthday. As a Section leadership we should like to celebrate this event in a decentralised and individual way, if possible at the farms where farmers are actually at work. We have taken the opportunity of this birthday to take stock of 90 years of biodynamic farming worldwide. How has this impulse of Rudolf Steiner realised itself in the flourishing of agriculture in all its diversity of branches and approaches? We have asked more than 20 specialists in the movement to contribute, and have produced documentation in the form of a book. We hope that this will enable the diversity and universality of the biodynamic impulse to become a uniting experience for us and for our partners in agriculture.
- Preparations project: This project aims to demonstrate the production of the biodynamic preparations. A team of four qualified young people from the biodynamic movement will hold conversations by 'dialogue-interviews' in order to learn about the 'thinking with the hands' that goes into preparation practice. From this they will produce documentation that forms the basis for a productive dialogue about work with the preparations. This too is dialogical work.

In this short report we have tried to illustrate a few examples of our research work. At the moment our research focus is not on producing scientific results, but on action and participation:

1. Our action research involves the Section taking on a theme that is vital to the movement and in this context acting, i.e. changing something. For example, new topics are elaborated, or new methods introduced into the movement, and we follow what develops from this. Thus we act while at the same time monitoring what we are doing and what happens. It is a reflexive process.
2. Our participative research involves us working with the movement to identify and change something. People from the movement introduce their knowledge, experience and requirements and the topic is worked on jointly. (1 and 2 according to a paper by A. Sedlmayr)

More information on the work of the Agriculture Section can be found in our 6-monthly newsletter which we would be pleased to send you:
sektion.landwirtschaft@goetheanum.ch.

Prospect: Evolving Science 2014

The Future of Goetheanism with respect to Nature, Society and Anthroposophy

Internationale Tagung der Naturwissenschaftlichen Sektion am Goetheanum,
15. – 19. Oktober 2014

The Glashaus, for decades the headquarters of the Natural Science Section, will be 100 years old this year. We would like to use this occasion to invite you to an international conference to work together on three basic topics:

Our relation to nature

Our involvement with the world of the senses, with the earth, is central to our natural science. This contributes significantly to culture, including that of anthroposophy. How should this involvement take place nowadays given the profusion of digital images and global crises (climate, dwindling resources, industrial agriculture)?

Our relation to society

Science affects society through its depiction of nature and the human being as well as through the technologies that it produces. In which direction do we want its formative influence on the human being to develop? What challenges should Goethean science pose in the age of large projects such as CERN, genome analysis, systems biology, nanotechnology, etc? Scientists need to ask themselves what significance their work has for society and what their position is in the context of science in general.

Relation to anthroposophy

What is the significance for our work of Rudolf Steiner's many indications and suggestions on the relationship of the world of the senses to that of the spirit? In what way is science helped by meditative work? Can we give a description of a way to the spirit in nature that is appropriate for modern consciousness? Furthermore, Rudolf Steiner envisaged the possibilities of new social forms determined by the kind of thinking used in science. This means that the way in which we think will inform the way in which we will live together in the future. By considering the fact that spiritual activity is important for the earth, we will round off the range of themes of this conference.

As well as lectures we intend to have specialist groups, continuing education for science teachers, open forums, and 'world café' sessions ? space for meetings, discussions, and issues for the future of our work. We also intend to give time for free discussion of controversial themes within Goethean anthroposophical science.

The conference languages are German and English. We warmly welcome people who are working in research or who are involved in science in their profession, such as teachers, pharmacists, etc., and especially young people who are studying in the sciences. We shall try to set up a fund to cover travel and accommodation costs so that participation is not prevented for financial reasons.

Part III.

Institute and co-workers

The Goetheanum Research Institute

Institute for Contextual Science (ICS)

Johannes Kühl & Johannes Wirz

The aim

In the Research Institute we extend and deepen the scientific work of the School of Spiritual Science at the Goetheanum. The Institute is run jointly by the Science Section and the Agriculture Section. We are open to working with other Sections of the School.

We believe that practical research with the methodological basis of anthroposophy is necessary in order to do justice to the questions of our time, and the kinds of problems arising in the various fields where anthroposophy is applied. In our view, meeting this need is essential to the role of the Goetheanum and its Sections. The Goetheanum site is unique regarding its interdisciplinary potential and involvement of people from all over the world.

Methods

Starting from Goethe's scientific work and Rudolf Steiner's spiritual science, we have already developed and tested a set of phenomenological methods. However, we continue to redevelop the research methods and adapt them to our objects of research. This means that in each case we look for the appropriate approach.

The apparent contradiction of developing a method for an object before one has studied it is characteristic of our way of working. Science, considered as process, requires a constant oscillation, a kind of breathing process, between scientific investigation and a re-examination of the methods used. The concept is presented to the phenomenon in a kind of courtship (*Werbung* – a term coined in this context by Hermann Popplebaum) with the question entirely open as to whether the phenomenon accepts it or not – the scientist is instructed by the object of study.

This allows various viewpoints to be adopted. In the sense of ‘cognitive holism’ (McClamrock 1989, Caruana 2000, Leiber 2008), experiential approaches ranging from analytics to idea- or appearance-orientated phenomenology and to meditative practice are all taken into consideration and integrated into the whole picture. In this respect, Goethe’s *Colour Theory* lead the way as a ‘multi-perspective’ and contextual science. Research of this kind is not restricted to studying the literature, but depends on observation and experiment. The approach is *immanent* in that all results gain their full meaning only in concrete relation to the human being. The ‘totality’ arises in the human being and yet belongs to the object.

Projects

Basic research is the focus of the Research Institute. Current research issues and the way they are dealt with are related to anthroposophy in a way that is not generally possible at other institutes because of their circumstances. The aim with this is not so much at direct application or at ‘scientific proof’ of anthroposophical findings, but rather at specific ‘cognition of the essence’ of the matter, the opening up of ways to nature and anthroposophy that accord with a scientific consciousness.

Depending on our workload we collaborate with other institutes and universities. Thus the work is intended to further the development of anthroposophical activities as well as to make a contribution to general scientific culture.



Education

As educational opportunities at the moment we offer an ‘intensive week’ and a summer university on studying the living world, various courses connected with other studies available at the Goetheanum, and we accompany individual students in their scientific projects. In addition to this we make many trips elsewhere to give lectures and seminars.

Besides our educational opportunities, we of course hold various conferences, exhibitions and seminars as well as a weekly colloquium.

Organisational

The Institute’s leadership currently comprises Jean-Michael Florin (Co-leader of the Agriculture Section), Johannes Köhl (Leader of the Natural Science Section) and Dr. Johannes Wirz (Co-ordinator). They represent the Institute jointly or singly by arrangement. The Institute’s co-workers contribute to its management in regular meetings and colloquia.

And to conclude...

We warmly thank all who have enabled and supported our work.

We especially thank the members of the Anthroposophical Society without whose membership subscriptions it would be impossible to carry on the work of the Natural Science Section and that of the Institute. On the one hand, these subscriptions cover the costs of the infrastructure and general running expenses of the Glashaus where we have been able to work for decades. On the other hand they also cover about a third of our annual budget. Without this basic funding, it would not be possible to order further materials for our work.

Next comes a list of private donors who have supported our work through donations of various amounts or who have directly co-funded individual projects. We very warmly thank all of them for this.

Most of our projects receive significant support from a number of companies and foundations. In many cases the respective projects would hardly have been possible without this funding. We would like to say a big thankyou to these too. They are:

- Dr. Hauschka Stiftung, Bad Boll
- Ellen M. and Ebbe Roberts Fond Dänemark
- Fondation de l'Aubier
- Fondation la Bruyère Blanche, Vaduz
- Hiscia, Verein für Krebsforschung, Arlesheim
- Humanus Stiftung, Basel
- Mahle Stiftung GmbH, Stuttgart
- Pädagogische Forschungsstelle beim Bund der Freien Waldorfschulen, Stuttgart
- Rudolf Steiner Fonds, Nürnberg

- Ruskin Mill Educational Trust, Nailsworth
- Sampo Initiative zur Förderung anthroposophischer Forschung und Kunst, Dornach
- Software AG Stiftung, Darmstadt
- Stiftung Forschungsförderung der Anthroposophischen Gesellschaft in Deutschland
- Stiftung Freie Gemeinschaftsbank Basel
- Universität Witten-Herdecke
- Verein Hortus Officinarum, Rheinau
- Wala Heilmittel GmbH, Bad Boll
- Weleda AG, Arlesheim
- Western Washington University, USA

2013 Accounts of the Natural Science Section

Expenditure (in CHF):		Income (in CHF):	
Salaries	570.000	General Anthroposophical Society	238.000
Administration	7.000	Earmarked contributions	322.000
Travel	8.000	Conferences, studies	45.000
Conferences, studies	12.000	Publications	10.000
Publications	11.000		
Project materials, literature	7.000		
<hr/>		<hr/>	
Total:	615.000	Total:	615.000

What we need

The future of our Institute is still a matter of concern and we would again like to share this with you. We regard it as essential that the Goetheanum is in a position to carry out research. Considering that the basic contribution from the General Anthroposophical Society has to support all the Section work and the Section Leaders with their outreach duties, their varied work with colleagues at the Goetheanum, and their travel commitments in the Anthroposophical Society worldwide, it is clear that the work of the Institute is carried out almost exclusively with project funding, the greater part of which has to be reapplied for each year. Therefore we are looking for ways that allow us more room for manoeuvre, for example to be able sometimes to invite students or scientists to work at the institute for a while, or to tide us over between projects or even occasionally to pursue themes that seem to be important, without immediately having to write grant applications. In the past year some of this was possible through the generosity of donors, but there is still no secure income for it.

Furthermore, we continue to regard it as essential that, in the field of Goethean science, courses and opportunities for training are offered for non specialists. Science can be one of the most important foundations for a free, non-ideological understanding of anthroposophy, but only if it is examined methodologically and 'reading in the book of nature' is practised. Our efforts to strengthen our financial basis in this direction have not yet led to a satisfactory outcome, and this also costs time and money.

For the above reasons, we are grateful for any support. Especially helpful to us are regular smaller (or larger?) contributions. If you have any questions about this please contact Barbara Schmocker or Johannes Kühl (see p. 44). We would be pleased to send you further copies of this report to pass on to your friends and acquaintances.

Johannes Kühl & Johannes Wirz

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BIC RAIFCH22

N.B. Please cite the relevant payment reference: ‘NWS 1100’ for contributions to Natural Science Section; ‘SL 1150’ for contributions to the Agriculture Section.

Our website

On the website of the Research Institute and Natural Science Section at <http://www.science.goetheanum.org> (also accessible via www.forschungsinstitut.ch) can be found further information about our work such as:

- a list of all publications since 2000
- up-to-date information on our conferences, seminars, the public colloquium of the Institute and the summer university
- research reports and project descriptions

- a bibliography of Goethean science
- information about our journal *Elemente der Naturwissenschaft*
- links to other institutes, information about their events, and various documents for download
- information and brief descriptions about recently published books
- pages giving brief explanations about the basic issues we are working on
- information on individual co-workers and their respective research interests and publications

The publication of this information was enlarged in 2012 and it is updated and revised. We are very pleased that in 2013 we were able to make the website of the Natural Science Section and the Institute available in English.

Our journal *Elemente der Naturwissenschaft*

The Natural Science Section publishes the journal *Elemente der Naturwissenschaft* which contains contributions from all branches of natural science and of picture-forming methods. It is issued twice a year.

Editorial team: Johannes Wirz (editor-in-chief), Johannes Kühl, Ruth Richter and Barbara Schmocker

Editorial office and subscriptions:

Naturwissenschaftliche Sektion am Goetheanum
Elemente der Naturwissenschaft
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Sample copies available on request.

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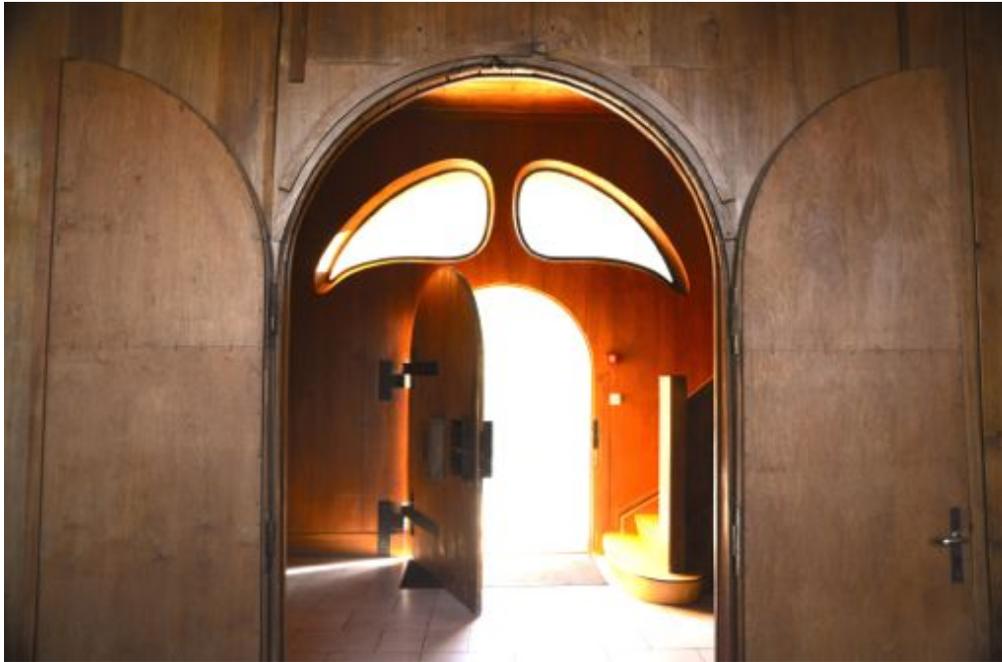
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Recent publications by the Institute's Co-workers

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- [17] Wirz, Johannes (2013): Sich von den Impulsen des Bienenvolkes leiten lassen. Fonds-Goetheanum, November 2013, pp. 2-3.

The complete list of all publications by the co-workers since 2000 can be found on the Section's website (<http://www.science.goetheanum.org>).

