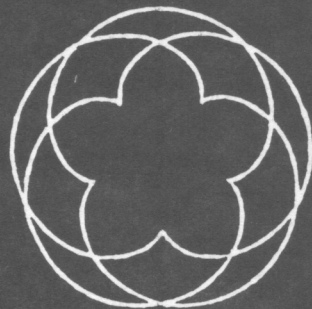


# SCIENCE FORUM



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## **Nº6**

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The editors would be pleased to receive such items for consideration (preferably typed in double-spacing).  
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*Anthroposophy is the name that Rudolf Steiner (1861–1925) gave to his Science of the Spirit. This has given birth to new perspectives and practical activities in the arts and sciences, in medicine, agriculture and education. Information on Anthroposophy and the Anthroposophical Society can be obtained from Rudolf Steiner House.*

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# Editorial

**D**o scientists have a special mission within the A.S. in G.B.? What sort of work should members of the Science Group be doing? What do we mean by 'Anthroposophically Orientated Natural Science'? Are social factors essential elements of the method of Spiritual Science?

These and other questions have been discussed within the Science Group during the last few years, and, not surprisingly, the discussion continues. The questioning mood is, perhaps, a reflection of the general world-situation, with its manifold problems.

Some problems on the frontiers of physics are discussed by Brian Stockwell in this issue of *Science Forum*, and the relevance of the work of Rudolf Steiner to the present position and its historical development is indicated. Robert Kersey Green's report of the 1985 Science Conference, held at Botton Village, shows the range and interest of the proceedings, which were enhanced by contact with the life and activities of the village. Nick Thomas further develops his examination of the scientific method in 'Generalisations, Universals and Science'.

Capillary Dynamolysis has been closely associated with the history of Anthroposophy and with suggestions made, personally, by Rudolf Steiner. Today, it is generally regarded, though not always in a precise way, as demonstrating the activity of the etheric or formative forces. In her article 'Anthroposophical Science with special reference to Capillary Dynamolysis', Agnes Fyfe describes essential features of the method and the significance of the 'pictures'.

Michael Friedjung, writing from Paris, indicates 'a path which may unite science with the spiritual', involving the concept of spiritual beings active in both organic and 'inanimate' Nature. In a related article, he attempts to show the practical value of such an approach by predicting future astronomical events (the positions of bright

novae) in the period 1986-1996.

Hedley Gange refers to the holistic trends which seem to be arising out of the Spirit of the Time—and perhaps, also, as a reaction against the narrow specialisation of an earlier era. Can the growth of 'holistic science', on a wide scale, be facilitated by envisaging a possible integration of the various interests, processes and aspirations involved?

Consideration of the above topics may perhaps help to answer the question 'what should the Science Group be doing?' The possibilities are surely very wide, embracing scientific, artistic, ethical and social aspects. Approaches vary with individual interests and background: inspiration may come from historical associations or from a demand of the time.

## News

A one-year full-time Training Course for Science Teachers in Waldorf Schools will start in September 1986 at Wynstones School, Gloucester. Details are given on page 26.

A contribution to the dissemination of scientific information has been initiated by William Steffen in his 'Periodicals Reference Data Base of Goethean Science' (page 29). We hope that readers will make full use of the facilities offered.

## New Arrangements for Science Forum

Distribution of this issue is being undertaken by the Rudolf Steiner Press, and *Science Forum* is to be included in the advertising literature and catalogues sent out by the Press. These arrangements should result in an increase in the circulation and influence of *Science Forum*, but this will be dependent upon a steady flow of contributions—articles, news items, reviews and letters—from our readers. The situation will be reviewed after an experimental period of twelve months.

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# Trends in Physics

Brian Stockwell

It is timely, nearly a century after Rudolf Steiner began the development of spiritual science with his study of Goethe's scientific work and the publication of the *Philosophy of Freedom*, to seek an overview of modern science in the light of Steiner's insights. I shall try here to review some trends in physics. How does physics stand now, in relation to spiritual science?

When Steiner was writing *Goethe as Scientist*, the orthodox view was that physics was moving towards final statements of the structure and laws of the physical world. But beneath the surface disquieting discoveries were coming together to disrupt complacency. Maxwell's electromagnetic field equations, the Michelson-Morley experiment which failed to detect the luminiferous ether, Mach's criticism of Newton's absolute space and time, discrepancies in the phenomena of heat and radiation, Thomson's discovery of the electron and Planck's quantum hypothesis were the prelude to the Einsteinian revolution. Einstein, besides special and general relativity, opened the door to the subatomic world with his synthesis in 1917 of the Bohr model of the atom and Planck's quantum theory.

This all took place in Steiner's lifetime and he took account of it in his science courses and in references scattered plentifully throughout his work, e.g. on the structure of matter, the nature of light, the role of heat between matter and spirit, and generally the working of etheric formative forces within the physical world.

Nuclear and particle physics came later, beginning with the development of quantum mechanics in the period 1924 to 1930. Since then the pace of discovery, in both experimental and theoretical physics, has enormously intensified. It ranges from nuclear energy, a profusion of elementary particles, the microchip and lasers

with all their new technology, and vast new horizons in astrophysics; to the philosophical minefields of the uncertainty principle and the role of the observer in quantum experiment. It is claimed that quantum theory has played a significant part in the discovery of the double helix, the breaking of the genetic code and hence molecular biology and genetic engineering. All these developments, and others yet to come, were foreseen by Steiner. Their foundations had already been laid, and above all the mode of scientific thinking set, by the time of his death in 1925.

Spiritual science was based on the assumption that there was no impassable barrier between the physical and spiritual worlds, no inherent dualism of matter/spirit, science/religion, object/subject. Man possessed the key to knowledge of both worlds; the seamless garment of the universe was broken only by man's own organization, making it necessary for him to strengthen and transform his thinking to overcome the apparent divide.

The dominant materialist view is not only that the world is understandable in physical terms alone, but that spirit does not exist and consciousness is an emanation from the physical, a result of Darwinist natural selection. This view has not been substantially affected by physicists such as Capra and Bohm, who are beginning to look for holistic explanations of the more bizarre findings of the orthodox (Copenhagen) interpretation of quantum mechanics. Popular science, increasingly propagated by the media, is unequivocal in its atheism. A physical explosion was the beginning of everything we perceive and know; the gene is the master of all life; the physical brain is the bearer and instrument of the whole range of human experience.

The opposition therefore between spiritual and natural science has grown more profound. It is true that dualism,

established in science since Descartes, has been losing its hold on physics—but it is because any concept of spirit has disappeared into matter, while objectivity is questioned by the role of the observer in quantum mechanics. The frontier of sense perceptible knowledge has been passed in physics as well as in spiritual science. But what new country has opened up?

For anthroposophy it is a spiritual world. For physics, it is a strange territory, opaque both to perception and understanding. Immediately in question is whether this is a 'real' world. Physicists and philosophers of science debate once more whether it is possible to discover reality at all—ground fought over by Locke, Berkeley, Hume and Kant (and surely settled once and for all, unnoticed by science, in Steiner's *Philosophy of Freedom*). The 1983 quantum mechanical experiments in Paris appear to have finally established 'non-separability', or interaction between formerly associated particles at a distance beyond the reach of a light signal. This either violates special relativity or suggests a hitherto undiscovered kind of physical relatedness. Another question is whether we select and even create phenomena by the experiments we choose, e.g. the kind of information sought by space probes; and the choice of hypotheses for experimental investigation. After Dirac proposed the existence of an anti-electron, the positron was observed in cloud chamber photographs. It may have been appearing unobserved before. Physicists tend to find what they expect or hope to find.

Mathematics has increased its central role in physics. Here, in anthroposophical terms, the human spiritual faculty is creatively at work in its manifestation as pure thinking. But it is symptomatic that we have passed from the speculation that 'God is a mathematician', and from Einstein's

wonder at the beauty of the correspondence between the physical universe and the working of the human mind, to the frequent substitution of mathematical models for the perceptible world. It is true that experiment is still the final test of these models. But the picture of the universe presented by astrophysics is now heavily dependent on hypotheses so far tested only mathematically. Mathematics is at once a tool, a language and an art (Novalis called it a poem): its beauty and exactness may lead theorists to forget that its statements do not necessarily coincide with the experience which science aims to relate and explain. For Steiner, it must grow beyond intellectual empiricism to engage the whole man, so leading on to spiritual experience.

Ever more ambitious theories of the structure of the universe match the ingenuity of the investigation of the atomic structure. But they are inevitably less securely based on experiment and owe more to mathematics. The confidence with which details of the Big Bang and its aftermath are stated is matched by the daring of new 'supertheories'—supersymmetry, supergravity, superstring—designed to unify the four basic physical forces in a 'theory of everything'. New types of particle, some still shadowy or like the 'graviton', not yet found, are seen as mediating the action of these forces on a cosmic scale, as with the photon in the electromagnetic force. Where Newton had to be content with the hypothesis of unknown forces whose effects could be calculated, physics now calculates the entities responsible and then searches for them. Both in the macrocosm and the sub-atomic microcosm it has become more difficult to reconcile the materialistic and spiritual understanding of nature. Steiner's statement that the effectiveness of physical laws discovered on earth diminishes with distance into the cosmos would, if established, cut away in an instant a mountain of speculative labour.

Obviously it would be a mistake for modern spiritual science to belittle or ignore the findings of science. Steiner certainly never did. It is one of the glories of our epoch. However strongly he warned against wrong assumptions

and interpretations, he stressed that the *facts* of science must be allowed to lead on into the spiritual. What was wrong was its one-sidedness, the belief that a part of reality was the whole. While physics was largely engrossed with dissecting the corpse of the universe, biology saw the origin of life in matter. For spiritual science, it was the other way round. The very virtues of natural science led it along the path first into total materialism (in Steiner's lifetime) and now into what Steiner predicted would be worlds of Ahrimanic fantasy—a prison for minds entangled in pictures of a subnature where only 'fallen' etheric forces were to be found.

It is interesting to speculate whether for Steiner there was a particular crucial period when science *could* have broken through the boundaries it set itself, and moved on to include the spiritual at work in nature. It may have been the time when mathematical modelling entered its heyday; when the boundaries of direct sense perception, aided by instruments, were passed and science turned its back on unbiased observation in Goethe's sense. Instead we moved totally into a twilight realm of particles only indirectly observed, underlaid by 'unknowable' energies, with mathematics our only hold on reality.

In his 1920 lecture course *The Boundaries of Natural Science*<sup>1</sup>, delivered to an audience of scientists, Steiner specified not particular areas of physical research to bring science across the boundary, but development of 'imaginative cognition', the first stage of the anthroposophical path to supersensible knowledge. The implications of this need to be considered. It seems an unlikely path for professional scientists to be persuaded to follow. Was it seen by Steiner as an urgent alternative, at that crucial time in physics, to the increasing reliance on mathematical thinking? He frequently warned, for instance in his course on astronomy, of the danger of mathematics becoming a substitute for exact observation; a danger not unrecognized among scientists today. In current debate, for example, there is concern about equations in quantum electrodynamics and in relativistic quantum theory which produce infinities, and their removal by mathematical devices like 'renormalisation'.

Another contrast lies in the question of origins. Physics deals with the *how* rather than the *why*, and usually recognizes that it does so. In a series of discussions broadcast by French radio<sup>2</sup> the question "Why is there matter?" was ascribed to metaphysics, and it was said that physics can only begin after two basic assertions about reality have been made; that there is "something rather than nothing", and that there is "music rather than noise" (i.e. organization in the universe). If these were attributed to natural laws, the question was only transferred to why are there laws. But while there might be general agreement among physicists to leave origins to metaphysics in this way, the big majority of science popularisers are dogmatic about the denial of spiritual creation and the origin of consciousness in matter.

For Steiner, man wants to discover the *why* not just because he feels the need to know the causes of things, but "the need to become human in the fullest sense through observing nature". The damage inflicted on social thinking by the impotence of the modern scientific method was penetrating all realms of life. That situation is worse today because science has only intensified its abstraction. The exactness of mathematical thinking, transformed as he suggested, would bring something better than sociobiology into social life.

I mentioned earlier the holism of Capra and Bohm: still a small but important trend in quantum philosophy. Within physics it seems that a more healthy intuition is struggling to break out. What is its significance? It would be deceiving ourselves to believe that Capra's likening of the subatomic energies to the "dance of Shiva" is a breakthrough of the kind Steiner looked for. It is derived from the uncertainty principle and the involvement of the observer in quantum mechanics, which lead Capra and others to suggest that it gives insight into the nature of mind as well as matter, I believe this to be a profound mistake.<sup>3</sup> There is a disappointing anticlimax if, scenting a breakthrough, we look for spiritual substance in the conception of a sub-quantum 'dance'. It is still part of the limited picture confining us to subnature.

Nevertheless, it is important that physicists should look in the direction of the part played by consciousness in the investigation of matter, even though they are unaware of the light thrown by Steiner on the nature of thinking. It is symptomatic that Capra has gone on from *The Tao of Physics* to claim in *The Turning Point* that "every contemporary physicist would accept my main theme, that modern physics has transcended Cartesianism... and is leading us to a holistic and intrinsically dynamic conception of the universe".<sup>4</sup>

David Bohm has gone deeply into the possibility of a holistic world.<sup>5</sup> In the light of spiritual science his world picture at present appears contrived, a product of mathematical rather than (in Steiner's sense) 'imaginative' thinking. He and many other writers illustrate both the creative and the brittle aspects of pre-spiritual conceptions—everyone can have his own theory of the universe; and the result is a growing number of highly skilful and deeply knowledgeable cosmogonies which are conceptually abstract.

How then does this mass of discovery—in astrophysics not yet firmly established, but in the quantum world mostly embodied in technology that works—relate today to spiritual science? For there is no question that quantum theory works, however puzzling its philosophical implications. The biggest outstanding questions here are non-separability; the role of the observer; and the relationship between subatomic particles obeying quantum laws, with their inbuilt uncertainty, and the everyday world of perceptible objects, which are composed of particles but obey the laws of classical physics and inter-relate directly with human consciousness.

In astrophysics, from its very nature dependent on calculations from light and other electromagnetic phenomena, there is still a ferment of competing theories. Black holes are not proven. The calculated age of the universe changes. The interpretation of the redshift and the size of Hubble's constant are under review; the nature of quasars is in dispute. The 'inflationary' universe is the latest scenario for development since the Big Bang. There is recent controversy, probably shortly to be settled by Voyager 2, over the atmosphere, magnetic field

and rotation of Uranus. 'Superstring', based on the idea of stringlike rather than pointlike particles and so potentially affecting the whole of physics, demands 10 dimensions.<sup>6</sup> Yet despite all this, the hypothesis of the Big Bang and the seconds and minutes following it is now widely accepted as fact.

I have referred to Steiner's acceptance of the 'facts' of science. Today it is even more difficult than in his lifetime to separate facts from interpretation. In the 1920 lectures already quoted, Steiner concentrated on the need for changed thinking about observed nature. For the other approach, that of following the detailed implications of the facts, there are all the clues we need in his writings and lectures. Some of this work has been done and is being done, at the Goetheanum and elsewhere. I will mention only four of the clues here. Perhaps most important are his references to atomic structure, where he limits 'reality' (itself a term needing discussion) to particles which still contain some element of the light and warmth ethers. Then on scientific method: the results of observation were sometimes jettisoned if they conflicted with or complicated the ruling theory, e.g. the example he noted of the omission of certain details of Kepler's planetary laws, or of Copernicus's third axiom, in modern astronomy.<sup>7</sup> Then one of any number of smaller examples: whereas mathematical science tends to import extra dimensions, Steiner commented that to discover reality (and here he meant the spiritual world) we must on the contrary find fewer dimensions, e.g. only two in the Imaginative world.<sup>8</sup> Finally there is the fundamental question of light.

Physics looks exclusively at photons with their wave/particle duality. But here there may be a meeting-point for natural and spiritual science. Steiner said matter was composed of light; physics says it is composed of energy, in various forms of particle and force. Steiner spoke of a fundamental substance underlying all earthly phenomena.<sup>9</sup> Quantum theory speculates about an underlying, unknowable, energy from which particles are briefly produced by the observer and the measuring apparatus. Bohm and others suspect hidden variables behind the quantum world, discovery of which

could remove the puzzles about uncertainty and chance. Einstein's famous comments on light (that no-one really knew what it was and that he would like to spend a life-time studying it); and on quantum theory (that God does not play dice with the universe) remain pointers to unanswered questions.

There is a rich field for experiment as well as cognitive research in the effort to turn science towards what must be its ultimate goal. The two are combined, for instance, in the current work on heredity in plants at Dornach. It is to be hoped that this will lead to spiritual scientific understanding of genetics, which poses at present even greater difficulties for a spiritual world view than physics. The links between physics and genetics are increasing and significant, going beyond the familiar reductionist claims.

The urgency of the work is underlined not only by the sheer physical and moral dangers of the present scientific orthodoxy, from mass nuclear destruction to the contempt for individual life shown by embryo research; but by the constant propaganda of the science popularisers. They are able to convince millions, through books and the news media, that the universe is purely material, originated and governed by natural laws; and therefore that spiritual science is an illusion. It is not enough to elaborate conceptually the alternative world picture; we must be able to show in detail where the facts have been misconstrued. After all, Rudolf Steiner went straight to the roots of science and scientific thinking when he founded modern spiritual science.

#### Notes:

1. *The Boundaries of Natural Science* (1920)
2. Translated, edited and published in *Aspects of Matter in Science Today* by W. J. Duffin (1985).
3. For a full discussion of this question see *Towards* Vol. II No. 4-1983
4. *The Turning Point*. Wildwood House (1982), p.33
5. *Wholeness and the Implicate Order*. Routledge and Kegan Paul (1981).
6. *Superstrings: a theory of everything*. Simon Anthony, New Scientist 29/8/85
7. *Astronomy in relation to other branches of Natural Science*(1921)
8. *The Evolution of Consciousness* (1924)
9. *Manifestations of Karma* (1912).

# The Science Conference

Botton Village, 12-15 April, 1985

## The Nature of Rhythms and the Rhythms of Nature

*Opening lecture on the main theme by George Corrin.*

**W**hat is rhythm? It is more than mere metre or beat; it puts life into metre. Rudolf Hauschka was advised by Steiner to study rhythm and hence understand life. From this seemingly simple instruction has developed the Wala Institute and medicines. "True rhythm has the fundamental *regularity* but also the quickly responsive variability of the human pulse; not the mechanical, precise beat of the metronome. It feels time, goes in time but is not *dead* in time." Our sense of rhythm is stronger than that, say, of harmony. For this reason the dance element is found universally in human culture.

In Nature rhythms abound. Let us look at the extra-earthly ones first. We have day and night, new and old moon, the seasons, sunspots—these have been analysed to show 11, 40 and 80 year cycles. Also there is a regular pattern produced by the evolving sunspots across the disc of the sun. These cycles have been found to correspond with e.g. the water level of large natural lakes, with tree-rings, with wine-quality, mainly through rainfall variation. William Herschel (the discoverer of Uranus) found that even the price of wheat fluctuated in sympathy with the sunspots, via rainfall variation again. But our weather is not influenced just by sun and moon, it is also affected by the major planetary revolutions and rhythms.

In the earth itself we find rhythms and patterns, such as regular strata of rock types and coal seams. The soil itself exhibits time rhythms, for instance in soil acidity and phosphate levels. Thus soil acidity is least in the autumn but rises to a peak in winter. Bacterial activity in soil is a maximum in spring and again in autumn. A really convincing explanation of this is yet to be found. It is not simply a

matter of varying temperature. It is not directly linked to planetary motions, since it is an annual rhythm, nor is it based purely on mineral changes, but involves organic forces as well.

In trees, rhythms appear in multitude, both visibly and invisibly. Magnesium content varies rhythmically in tree bark. Willow cuttings take most readily every 4 months, and rooting is best done at certain regular times of year. One can apply artificial rooting compounds to try to stimulate root growth, but these are of little benefit at the low ebb of the cycle. They can help the amplitude of growth but cannot help bypass the rhythm. Some tree rhythms take more than a year to recur; an annoying example is the biennial fruiting of fruit-trees, often to excess in either direction! This rhythm can be largely suppressed by thinning out every other year, after the major fruiting. One is reminded in all this of Goethe's primal description of plant life as a succession of expansion and contraction.

To the farmer, a vital concern is the rhythmical growth of grass. Grass root-growth peaks in July, and reaches a low ebb in November. However the growth of the blades passes its peak well before July. The bio-dynamic sprays have the same overall effect as a gentle push or kick on an already moving swing, at just the right time in the movement. Flowering in plants, and fruiting, will occur in certain types only with at least, say, 14 hours of daylight, or in others with 10 or 12 hours. This can be utilized in artificially stimulating flowers and vegetables to appear at other times than their normal ones. Tomatoes respond far better to alternating temperatures (and light) than steady ones. Strawberries have been produced artificially at Christmas time!

Animal rhythms range from the obvious to the curious such as the speeds in earthworms. Egg hatching times in birds are based on a weekly rhythm; song birds  $2 \times 7$  days, domestic birds  $3 \times 7$  days, owls and falcons  $4 \times 7$  days, hawks and buzzards  $5 \times 7$  days, eagles  $6 \times 7$  days, emu  $8 \times 7$  days.

In the human realm a healthy mental life is based on rhythm, just as our physical body is best sustained in regularity and our physical life is based on biorhythms. Rhythmical jobs and activities stimulate thinking; rhythm is vital to meditation, in which, says Rudolf Steiner, rhythm takes on the role of force. Unhappily these days rhythm has been degraded to routine in our daily life, and in our economically-based agriculture, and hence the food we eat is similarly degraded.

A fascinating example of the creative power of rhythm is the forming of sand patterns on Chladni- and Jenny-plates. "Here, the substance builds up a visible expression of the rhythmical vibratory energy activating the plate, but really it is the *space* between the substance-pattern that is the true picture of the forming force. The visible world is a world of effects; the causes are found in the invisible world, the spiritual world."

### Discussion

Different rhythmic phenomena, mechanisms and situations, and their regular and variable elements, were discussed. Reference was made to the effect on human life of changing natural rhythms and conditions, e.g. through artificial lighting.

Astral and Ego influences in rhythmical processes were considered. Animal rhythms come from within; there can be a polarity between internal and external rhythms.

# The Periodic Table of Elements

Howard Smith

This is an Earth-centred arrangement, based on gravity and weights. Hence the significance of, say, the planetary metals does not stand out. Attempts were made in the mid-19th century by Lavoisier, Döbereiner and Cannizzaro to set out an order of the various elements. Newlands put forward his Law of Octaves. The final full form was given by Mendeleev and filled out in detail when the atomic numbers were accurately determined by X-ray spectra, obtained by bombarding elements with high-energy electrons, and by the mass-spectrograph.

The numerical progression of numbers of elements in each Period within the Table is based upon the squares of the first four natural numbers (fig. 1)

The modern periodic table is divided up according to s, p, d and f blocks. While these can stand empirically, they have very strong quantum-mechanical associations, s, p, d and f 'orbitals' being regarded as sub-levels of electrons within each main orbit or energy level. Briefly, when we find these sub-levels, there is always one s, three p, five d and seven f. Hence these are governed by the first four odd numbers, also known as the 'gnomen numbers' since they give the number of squares constituting each L-shaped section in the square.

Such number patterns, showing e.g. the relation between two series of numbers as here, were of great interest to the Ancient Greeks.

1			
--	3		
--	--	5	
--	--	--	7

This has been elaborated by Blickle and Bindel in *Die Drie* 1948.

Looking at the 4 Groups in turn, hydrogen and helium are those elements that tend to fly out of the earth's influence. Their molecular velocity is greater than the escape velocity of the earth; 25,000 mph.

Periods 2 & 3 are air/light elements, which evolved during the 'sun' stage. Thus all the main constituents of the atmosphere, N, O, CO<sub>2</sub>, Ne, Ar, are in these periods. Na, Ne and He are used in light bulbs, and carbon is used in the arc-lamp. Phosphorous means 'light-bearer'.

Periods 4 & 5 may be viewed as water elements, although the connections are admittedly more tenuous here.

The Earth elements in the last Periods are, as it were, 'over-developed' ones. Perhaps they are over endowed with Saturn and Sun qualities, and radioactivity may be viewed as a release of these as heat, light and the gas helium? (See Note 1.)

## Discussion

Do compounds literally contain the elements as such? Do sodium and chlorine really exist within salt merely because they can be analysed from it? (See Nick Thomas, *Anthroposophical Review* Vol 6. No.2, 1984). We can see (if not *perceive*) that iron is within blood, in that the nature of iron is manifest in blood. But is the fire nature of hydrogen to be found in water? The alchemical description of the marriage between elements was referred to, which involves sacrifice namely the heat of reaction (Ernst Lehms).

Is one justified in criticising atomic theory unless one can put something pretty convincing in its place? Materialism has crept in so often when one scientist's work has been adopted by another. Many original discoverers, like Darwin, were far more open-minded than their adherents.

Is chemical transmutation, quoted for example in the *Agricultural Course*, a valid idea? Can we prove it? Hypotheses are justifiable if they are, in principle, replaceable by later direct observation, e.g. etheric forces. Atoms on the other hand are not of this nature, any more than they have attributes, like 'sweet' or 'black' or 'dense'.

Fig. 1. Periods:	1	2 & 3	4 & 5	6 & 7
No. in period:	2 (2x1 <sup>2</sup> )	8 (2x2 <sup>2</sup> )	18 (2x3 <sup>2</sup> )	32 (2x4 <sup>2</sup> )
Element:	warmth	air	water	earth
Planetary epoch:	Saturn	Sun	Moon	Earth

# Goethean Science faced with the expanding realm of scientific observation

William Steffen.

Steiner's main contributions to science and philosophy directly were given in 1886 *Theory of Knowledge*, 1893 *Philosophy of Freedom*, and the 1920-22 science courses on light, colour, warmth, and astronomy. Just at this latter time, Hubble was investigating the red shift and the distant galaxies. Simultaneously, particle physics was going beyond atomic models in the Schrödinger wave equation, and into quantum mechanics. Today's theory of the Big Bang rests on rigorous mathematical formalism, but yet on extremely few observations: these are (a) the expanding universe, assumed from red-shift spectra, and (b) the 3.5°K background radiation. But how poor these compare with e.g. Goethean plant observation. These few and highly inferential observations present great problems to us in finding the ur-phenomena, or world-thoughts as Steiner called them in his latter years.

At the same time, some non-Euclidean geometries can present us with much the same problems, as being not within our direct everyday experience. Georg Unger suggests that 'probabilities' can be thought of as partly-incarnated beings, who have potential for doing things.

## Discussion

Our present day observation and concern for the earth and society are getting drowned in sheer numbers and statistics, in science, ecology, medicine, economics and politics. Surely the numbers are not our true concern, but Nature and society itself.

Steiner once asked: "Why do we actually perform experiments? Because we need to remain conscious, whereas Nature herself tends to send us to sleep." Christ has made more than one sacrifice to keep our senses trustworthy, in response to Lucifer's activities.



# Rhythm

Nick Thomas.

Can we be scientific about rhythm? Is rhythm etheric or astral, since the astral is the forming power within or behind "etheric formative forces". Is rhythm an entity in itself, or is it only a property of something? Waves (of light) were felt at first to presuppose an ether, a medium. The Michelson-Morley experiment then disproved this, and Einstein took this on board in the relativity theories, so waves of radiation were conceived as self-supporting, and 'ether' (a term Steiner was never happy with) became obsolete. So we are left now with a pure concept. After all, Steiner speaks of Spirits of Motion, not Motion of something. Hence rhythm, at this level, is a concept. What is a phenomenon?—it is a percept, given a conceptual background. Perceiving and conceiving themselves flow and alternate in a rhythm.

Now in the the Warmth Course we find the relationships shown in Fig. 1. An example of the direct connection between complex numbers and oscillation can be found in the control engineering of radio telescopes. (see Fig. 2.)

How do space and counterspace interact? Crossing a boundary can be a process of either materialization or dematerialization. These are represented in projective geometry by transformation, and moreover are rhythmic.

What is the role of rhythm in music? In terms of our threefold soul life, melody is linked to thinking, harmony plays into our feeling, and the rhythm lives in our will-life. A reflection of this is found in Fourier transforms. (Fig. 3.)

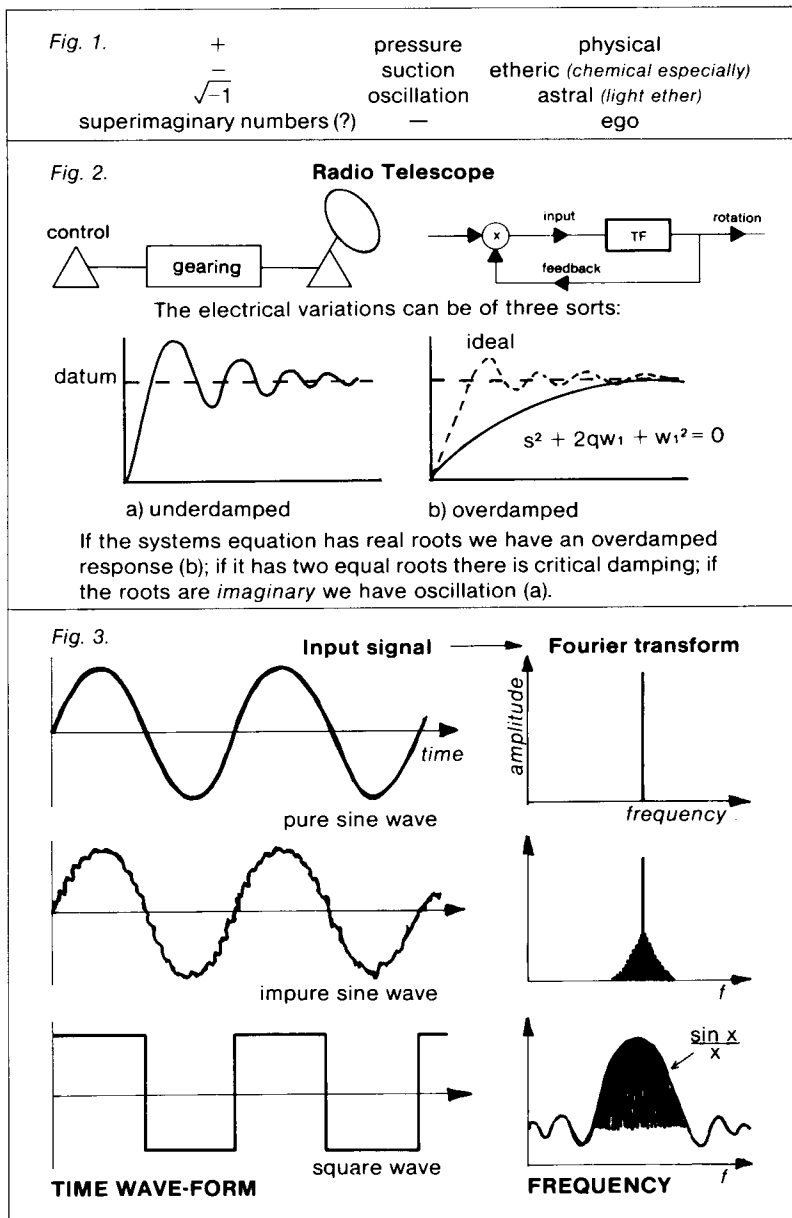
In Lecture 3 of *Wisdom of Man, of the Soul, and of the Spirit*, given in 1909, Steiner says that in order to perceive the ninth sense, of sound or speech, we have to transform melody into harmony, ignoring the fundamental. For the tenth sense, of concept, we use the astral body

to get to the meaning. For the imaginative sense, we use the two-petalled Lotus Flower, and the astral body then projects its own astral substance.

Finally, from *Letters to Members*, 1 March 1925, "Michael's world is within the human world of rhythm".

## Discussion

With regard to Nick's definition of a phenomenon, Steiner quite often gives us a heirarchy of concepts. In Goethean observation, as many preconceived ideas as possible are laid aside, and the arrival of the right concept is a revelation, a surprise.



# What is Spiritual Science?

Hedley Gange

(At the Jan 82 Conference, reference was made to the way in which the social conditions and organization of the Anthroposophical Society could influence the standing of spiritual science. At the Jan 84 Conference stages in the development of spiritual science since 1925 were briefly considered, and the question was asked, How do we intend that spiritual science, in a wide context, will develop during, say the next 20 years?)

What is spiritual science—as practised in 1985? A knowledge of the work of Rudolf Steiner is basic, of course, but the question can only be answered through observation of the actual situation. The method of spiritual science may be approached, in one way, as an extension and development of the method of natural science. Spiritual science requires the training and use of many faculties that are not demanded by natural science. Some of these faculties, connected with personal development, are indicated in *Knowledge of the Higher worlds*. Others related to the study of etheric, astral and other forces in man and nature, are described in *Man or Matter* by E. Lehrs; further faculties are concerned with artistic abilities, social laws, etc., others with spiritual perception and vision. The method of spiritual science combines all these wide-ranging faculties, with the object of eventually achieving a working system comparable in its universality with natural science.

The historical development of the method of natural science has been well documented: how should we describe the development of the method of spiritual science, during the last sixty years? Are we justified in describing spiritual science, as a working system in its present form, as 'scientific'?

## Discussion

Anthroposophy is a field of a *new* interpretation of life. We can be simultaneously both seer and knower. This is entirely new, so it leads to a new post-Kantian philosophy of science.

Rudolf Steiner should not be re-

garded as a universal authority, in the old sense; he may even have been wrong in some details, as space probes may show. A radical change took place at Christmas 1923 in the relation between Steiner's personal destiny and the Society, as well as that between the Society and the

School of Spiritual Science. The latter has a different nature from the former Esoteric School.

Spiritual Science may be interpreted as research into the spiritual worlds themselves. If so, it does not include Biodynamics, Camphill or Capillary Dynamolysis.

## Rhythm and Modern Technology

Hedley Gange

Rudolf Steiner stressed the importance of being aware at all times of the way in which the forces of sub-nature affect our lives. This is often very difficult under modern conditions. One approach is to try to grasp the plan of Lucifer and Ahriman, which they have been realizing step by step over thousands of years, and which today manifests in the extraordinarily complex world of electro-technology, where electromagnetic rhythms, resonances and alternations have created an imitation of the natural world. We read of the plan of the Highest Spiritual Beings, which preceded the evolution of our solar system (*The Spiritual Hierarchies*, Lect. 5), but it is salutary to reflect, also, that the counterplan of the negative forces is being promulgated at the same time. Something of the nature of this plan can be experienced in modern technology.

## Practical Session

with Philip Kilner

Here we looked at beats and interaction of beats, using pendulums. Then we dwelt on the manifold properties of water, by direct observation. Finally, the pulsing within liquid streams falling down smooth plastic sheeting, and the metamorphosing of ink drops falling down water columns were shown on film. The implications of these in terms of heart function and growth, and recovery from illness were discussed.

## The Polarisation of Light

Howard Smith

Referring back to two conferences ago on the polarization of light, Howard produced two tourmaline crystals, of the type Steiner himself would have used, rather than strips of modern polaroid, to get the ur-phenomenon as Steiner would have observed it. The crossed crystals produced a dark brown colour, otherwise green light is seen through them. Each crystal has strong linear grooves, and hence cleavage planes and properties. Nick Thomas reminded us of his earlier experiment with three crossed crystals, in which light is not fully cancelled out, in defiance of classical theory.

## Water pressure in plants

Stuart Brown

Experimental work has been carried out in connection with Lawrence Edward's work on tree buds. The internal pressure is measured indirectly by tree trunk diameter variation, to within 0.01 mm. Care is taken to eliminate thermal effects, using a simple computer programme. 13 trees, of several species, including birch, oak, hornbeam, willow, beech, pine and maple, have been used. To date, no detectable movement has been recorded, beyond random errors. However the project continues. It was noted in passing that all diameters shrink when the ground and the air are below freezing point.

# Homoeopathising and Potentising

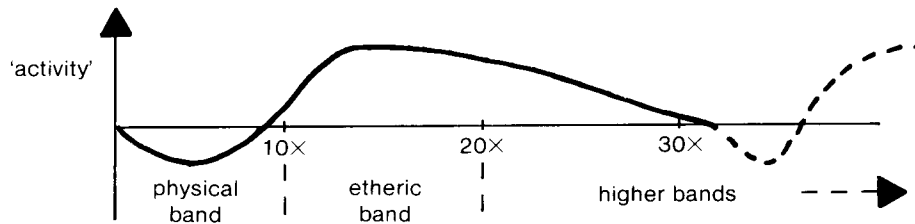
William Steffen

Work carried out by William during the last two years was briefly reported. In the Medical Course, Steiner uses the term 'potentising' when speaking of the up-building part of human digestion. Lily Kolisko did investigations over many years into the effect of each potency upon plant growth, to show the degree of the 'activity'. There is now a need to show the efficacy of homoeopathic remedies to the Health Authorities. Very little work can be claimed as sufficiently well documented. Jean Kollerstrom surveyed over 100 papers, and only 3

were up to standard! Sadly, little of Kolisko's work can be used in this capacity. Raynor Jones used baking yeast cultures to establish a measurable activity, getting up to 30% variation relative to the control. William found, with two kinds of yeast, that he was unable to get such results. Many conversations followed both here and abroad, and opinion tends to disfavour straight repetition of these tests. The effective elimination of stray electric fields is not easy in today's labs. (and Jones's lab. had such fields in it also).

## Discussion

This centred on questions of the possibility of tissue culture for use in an efficacy demonstration. Alternatively, should we not go directly to assess either patients, or say, liquid properties after succussion? An efficacy demonstration of this kind is neither easy, nor is it wholly ethical, as Dr. Kiehnle has stressed. So large problems remain, despite the urgency. Reference was made to the possible influence of the planets on such results.



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## Final Evaluation of the Conference

Enthusiasm was expressed for a further Conference, hopefully at Wynstones in January 1986. Suggested topics included further aspects of rhythm (biological and musical), the goal of Goethean Science, and contemporary developments involving moral and social

aspects such as heredity, surrogate motherhood and abortion.

Means of achieving improved communication between members, for example in connection with specific studies, were discussed. This could be done in the first place between individuals, leading perhaps to local

meetings or one day conferences of interested members.

It is hoped to continue our May meetings with Dr. Bockemühl at Emerson College.

Finally, grateful thanks were expressed for such a successful and widely interesting conference.

Robert Kersey Green

**Note 1:** A more detailed report on the Periodic Table, by Howard Smith, will appear in *Science Forum* No. 7.

# Towards a Spiritualized Science concerned with the Beings around us

Michael Friedjung

According to spiritual conceptions such as those of anthroposophy, the world only consists of spiritual beings. They range from elementals to the beings of the hierarchies and to the divine. Modern science on the other hand appears to teach a completely contradictory philosophy; the laws of physics, that is the laws of what is material, explain everything. Scientific results are based on rational deduction following experiments and observations; they have had to survive criticism by those who challenged them, and are known to work in modern technology. In comparison spiritual teachings given by a few or even in some cases by only one master can appear crazy, in particular in their descriptions of various spiritual beings.

The aim of this article is to indicate a path which may unite science with the spiritual, to show that present results of science if developed in certain directions may lead in quite a rational way to a spiritual view of the world. An attempt to identify the nature of consciousness in a clear way will be made, and the concepts so formed will then be applied in four stages to indicate the path. An aim for science will be suggested, also related to its various roles in human society.

## 1. What is the nature of conscious beings?

A basic thesis which is proposed here is that the presence of a conscious being manifests itself by *something which another being cannot control*. If there was only one being in the world, it could in principle decide everything, as nothing else could have the desire and the ability to thwart it.

This statement can be made in a

more precise way for certain conscious beings at least. In order to produce a desired situation, a being needs both knowledge and the ability to act; with only one of these it would be impossible to produce a desired result. The being must know both the results of different possible acts as well as be able to make them. Suppose one wishes to arrange objects in a regular pattern; one needs both to know the result of putting a particular object in a certain place, as well as have the ability to move it. Similarly if one wishes to divide an object such as a cake into a number of equal parts, one needs to both know the effect of any particular cut, and be able to make the cut. This kind of reasoning suggests that in the simplest possible situation the attractiveness of a desired result D is proportional to the amount of knowledge K multiplied by the ability to act A. In a case where the amount of knowledge is proportional to the exactness of a kind of measurement, and the ability to act proportional to the exactness with which one can act, the attractiveness of the result is proportional to the multiple of the two kinds of exactness. This simplest situation will be seen presently to be relevant for 'dead matter', but of course more complex situations can exist where such a simple mathematical expression is not appropriate. In slightly less simple cases however the attractiveness of a result D might not increase if the multiple of K and A was larger than a certain value, while in yet another case D might be proportional to the sum of different multiples K times A.

If a second being is present, and does not want a result desired by the first one, and cannot change the desires of the latter, it can either act to reduce the first being's knowledge, or its ability to act, or both. Hence the

presence of other beings when they only resist, can produce limits to K and A. Other kinds of relationship between different beings are possible. One may wish to use another and increase its knowledge and ability to act in a restricted way, so as to acquire an advantage. In *love* however the basic aims of one are also aims of the other, who therefore wishes the increase of the knowledge and ability to act of the former.

It must be emphasized that knowledge and ability to act may not be present in the same way as for human beings, but can also have 'higher', 'lower', or different forms. A dog knows its master; this is clearly not the same kind of knowledge as the abstract knowledge of a scientist.

Knowledge, the attractiveness of a result, and the ability to act, are clearly related to thought, feeling, and will. Knowledge can be considered a result of perception combined with thought, though in the case of an animal for instance this process need not be entirely due to the animal itself. Other beings such as 'group souls' can be present. Attractiveness is related to present feeling, while the ability to act precedes an act of will. Therefore one can say that there is a relationship between knowledge, the attractiveness of a result, and the ability to act, and the three basic abilities of the soul. However it may be noted that all these abilities may not be directly associated with an organism perceived by the senses such as a plant or an animal. Other 'elemental' beings for instance may also be present.

There is also a relation between the three abilities of the soul and the nature of time. Knowledge is related to the past, attractiveness to the present, and the ability to act to the future. However, knowledge need

not necessarily be the same as 'memory', but can be something more general.

Let us now try to find conscious beings with the characteristics considered here in the world.

## 2.

### The realm of 'dead matter'

A major revolution occurred in physics during the early decades of this century. The concepts of classical physics were replaced by those of relativity and especially by those of the quantum theory. In particular Nature was found to be not completely determinate.

In classical physics, which can be considered to have been founded by Galileo and Newton, one can predict the evolution of a physical system if one knows the initial conditions. Such a system can be considered as made up of particles, each of which has a position, a velocity, and a mass. If the positions and velocities are known at any one time, future movements are determined by the forces between the particles. When the forces are only gravitational, as is approximately the case for the motions of the planets, the physics (though not the mathematics) is fairly simple. Other forces such as those of electromagnetism exist, however, and need to be taken into account. The existence of other forces can, according to such conceptions, be for instance responsible for the mechanical properties of a body consisting of many particles. Nevertheless the presence of such forces does not change the principle of determinism, and predictions can be made based on knowledge of the initial conditions.

In order to know the initial conditions measurements need to be made. Modern science is that of the onlooker, who tries as little as possible to interfere with the phenomena he studies. He relies on 'objective' measurements made by instruments observed by him, and is suspicious of the scientific value of his own experiences. In fact one may say that the onlooker studies interactions between physical phenomena and

his instruments, that is between matter and matter. This approach is clearly far removed from that of Goethe and it was on the basis of it that the classical physicist believed in determinism.

Though not in contradiction with determinism, the rise of statistical mechanics during the nineteenth century indicated other possibilities. According to this branch of physics, many physical systems can be understood by considering the general behaviour of large numbers of particles, without needing to know that of an individual particle. The latter need not in principle have completely determined motions; it is the properties of large numbers which are determined.

Classical determinism collapsed in the third decade of this century following studies of light (and other forms of what physicists call electromagnetic radiation) and of atomic physics. It was found that it was never in principle possible to make, at the same time, the infinitely accurate measurements of all the initial conditions, needed for predictions of the subsequent behaviour of a physical system according to classical physics. This result is expressed by the Heisenberg uncertainty principle, which is valid for any body:

$$\Delta P \times \Delta S \geq h$$

where  $\Delta P$  is the uncertainty in the measurement of momentum (equal to velocity times mass),  $\Delta S$  is the uncertainty in the position, and  $h$  is a fundamental constant of physics, Planck's constant. The Heisenberg uncertainty principle can also be expressed by:

$$\Delta E \times \Delta T \geq h$$

where  $\Delta E$  is the uncertainty in the energy of the body, and  $\Delta T$  is the uncertainty in the time of the measurement.

The uncertainty principle can be understood if one realizes that, according to modern physics, matter behaves both as if it was composed of particles and as if it was composed of waves. (For an introduction to the subject as it can be taught to physics students see *Quantum Theory* by David Bohm, Prentice Hall, 1964

edition.) Certain experiments show the particle nature of matter, while other experiments show its wave nature. Each particle is associated with waves, whose properties give the probability of finding the particle at a certain position and with a certain momentum. For instance one can often consider that a particle is associated with what is called 'a wave packet', consisting of waves having a similar wavelength, and adding in such a way that the total amplitude of all the waves is large only in a limited region of space. The size of the region where the amplitude of the wave packet is large gives the position uncertainty, while the range in  $h/\text{wavelength}$  gives that in momentum. These uncertainties are related by the principle of Heisenberg. Similarly inside an atom one can consider a nucleus to be surrounded by a cloud of electrons, which are found in standing waves giving the probability of finding an electron at a certain position. These standing waves are regular, and their regularities explain certain regularities in the properties of light emitted by the atom.

Many physicists, including even Einstein, fought against the idea of a physical world where all is not determinate. However their objections were not generally accepted, and one can consider indeterminacy as representing a basic property of matter. Indeterminacy can be understood as being related to the *resistance* of matter. If one tries to make measurements and predict the future behaviour of matter, it resists. This is a resistance of matter against matter, of a physical phenomenon to be studied against a measuring instrument. The act of measurement introduces uncertainties; the measurement process excites a resistance. This resistance shows itself in other ways. The reason why electrons, having a negative electrical charge and surrounding a positive charged nucleus in an atom, do not fall into the latter can also be understood through Heisenberg's principle. The fact that atoms do not collapse explains among other things the solidity of solids, so that one solid resists another, as well as other properties of matter. Also

modern quantum field theory explains fields of force (such as electromagnetic and gravitational fields) by the exchange of 'virtual particles'. The energy time form of the uncertainty principle allows energy to be created for short times in the form of virtual particles before disappearing again. The exchange of virtual particles between real ones produces forces, which determine the nature of 'dead matter' as seen by the present day physicist.

If these results are considered from a spiritual standpoint, one sees something which makes one think of the interaction of conscious beings described in section 1. In a very simple case the attractiveness of a result that can be obtained by a being is proportional to the amount of knowledge multiplied by the ability to act. If the world is basically composed of conscious beings, the Heisenberg uncertainty principle can be understood as due to the resistance of certain beings associated with matter against others also associated with matter. One being resists the other, so its knowledge times its ability to act is limited. Hence beings associated with a measuring instrument cannot grasp everything connected with beings behind a phenomenon, because resistance occurs between the two kinds of being. Indeed one can say that if consciousness is basic in the world, an interpretation of this kind is required.

The question now arises concerning what kind of being can be found in 'dead matter', as studied by the onlooker. What corresponds to knowledge and ability to act? If one examines especially the second form of Heisenberg's principle, one immediately senses a relation between energy and the ability to act. In physics energy measures the ability to do 'work' against a force, so energy can be considered a kind of ability to act. Then the time of a measurement is related to knowledge. A human observer at least measures the time with respect to past events, while the energy present is connected with potentialities for the future. If this interpretation is accepted, the attractiveness of a result is related to

Planck's constant; what in 'dead matter' is connected with feeling has become a constant of physics!

To summarize what has been stated, indeterminacy can be understood as due to the resistance of beings associated with matter against other beings associated with matter, in which love appears to be absent. A kind of war of all against all seems to occur in 'dead matter', while what is connected with feeling is most easily understood as having become a constant of physics. This immediately suggests that the consciousness associated with matter is one which regiments feeling and makes it uniform, a consciousness which in anthroposophical language belongs to Ahriman.

The material world here described has two aspects. Its blind resistance with apparently uniform feeling gives a possibility of freedom to human beings who inhabit it, and do not need to worry too much about the feelings of the beings behind it. On the other hand one also has an indication of the presence of Ahriman, and hence a form of evil. Certain religions have indeed taught that the material world belongs to the devil, such as Gnostic sects, the Manicheans, and the Cathars. Thus even such a teaching which appears crazy to the modern western mind appears to contain part of the truth!

Another aspect of matter can be seen in the famous expression of Einstein,  $E = mc^2$ . The energy  $E$  is related to the mass  $m$  of an object and the velocity of light  $c$ . The energy contained in the mass may, if the present reasoning is correct, be considered a kind of ability to act, so mass may be considered as a condensed ability to act. In this case mass is related to will. This is not the same as saying that all is energy, as certain groups seem to do. The concept of energy is sometimes applied to many different things including the occult; when this is done only the willing side of the world appears to be taken into account.

Another point which needs to be emphasized is the relation between

the duality particle/wave in modern physics and that of point/plane in projective geometry. A particle exists around a point, while waves define surfaces perpendicular to the direction in which they are travelling, which in an ideal case become planes. The point/plane duality and the geometrical definitions which are based on it, can according to the researches of George Adams give an understanding of the relationship of the physical to the etheric. This relationship, it may be presumed, lies behind the particle/wave duality of physics, but research in this field is needed.

What has been expounded in this section partly resembles ideas of other authors. For instance the French author J. E. Charon in *L'Esprit Cet Inconnu* states that electrons are conscious, this being justified on the basis of a theory of 'complex relativity' not generally accepted by physicists. Another French author R. Ruyer in *La Gnose De Princeton* describes a conception popular among certain American physicists, according to whom matter is conscious. No justification of this conception is however given. The ideas of these authors do not go easily beyond 'dead matter', while the nature of consciousness appears to escape them. Here the consciousness of matter is related to the basic resistance of the material world, to what is a fundamental feature of the world around us, and which one encounters constantly in daily life. In addition reasons are here given for believing that consciousness in 'dead matter' is fallen and corrupt. Those who wish to base their whole philosophy on it therefore remain in the realm of Ahriman.

### 3. Life and what precedes it

The whole world is not 'dead', and the question arises as to what this really means. In order to begin to answer this question, one needs to realize that situations exist even in classical physics, where predictions cannot be made. In these situations the evolution of a physical system is extremely sensitive to the exact values of the initial conditions; an almost infinitesimal change of these

conditions has a major effect on the future development of the system. Conditions of this sort are now called 'chaos', and interest many physicists at the present time. They occur for example in fluid mechanics, particularly in the study of turbulence.

According to I. Prigogine, a nobel prizewinner in chemistry (see *La Nouvelle Alliance* by I. Prigogine and I. Stengers, Gallimard 1979), such concepts can be applied to 'dissipative systems' and in particular to life. Dissipative systems dissipate energy far from what is called thermodynamic equilibrium, and this dissipation becomes a source of order and regularity. In their development they can pass stages after which they can follow two different evolutions, each being consistent with the previous conditions. Dissipative systems are present in the 'non living' world as well as especially in living organisms.

One can say that in the type of situation now discussed, large scale systems become so sensitive to small perturbations, that the indeterminacy of the quantum theory which is normally minute for large scale systems (but not of course on the subatomic scale) due to the smallness of  $h$ , becomes also important on a large scale. The sensitivity of such a physical system is so large to small perturbations, that one may say that other beings can incarnate, beings different from those discussed in section 2. The indeterminacy goes beyond that expected from a simple application of the Heisenberg uncertainty principle; indeed Prigogine and Stengers in *La Nouvelle Alliance* define a similar kind of indeterminacy, which can at least be applied to certain kinds of chaotic systems. In view of all this it appears justified to say that chaotic systems go beyond the state of normal 'dead matter', and that living organisms are at an even more advanced level. One may suggest that the beings which act in and through living organisms act over a period of time; a plant goes through stages of development studied by Goethe. In addition the beings now discussed need not be fallen like those of 'dead matter', the attractiveness of a result for the beings

associated with life need not necessarily be related to a constant of physics. However the last assertions need to be tested through more research.

One point which needs to be emphasized is that in the case of a human being the being incarnated is not the body. Different beings can be associated with different processes of the body, which is sensitive to the action of these beings; this is not equivalent to their being produced by bodily processes. The same is clearly true for other living organisms.

It is not a coincidence that anthroposophists doing scientific research have found that the concepts of projective geometry appear applicable both to living organisms and to fluid motions. The relation between the particle/wave and point/plane dualities has already been mentioned in section 2, and the appearance of indeterminacy in new situations may be expected to be shown by the relevance of the point/plane duality. George Adams applied the mathematics of counterspace (whose opposite nature to ordinary space can be understood through the last duality) to plants, while Lawrence Edwards in *The Field of Form* uses concepts of projective geometry for plants, the heart, and watery vortices. If the reasoning used here is correct, the etheric shows itself where there is indeterminacy.

What has been said in this section is clearly very provisional; and many researches need to be done to test statements made. In addition certain experiments performed by anthroposophists, to show the presence of formative forces and the etheric, are probably connected with the study of chaos and not completely determinate situations, where beings can incarnate. Much work needs to be done before these things are well understood.

#### 4.

#### The cosmos

What has already been said can clearly also be applied to astronomical phenomena. However another aspect needs also to be considered, which if

true would be still more radical.

The principles of physics are applied in astrophysics to explain astronomical phenomena, and it is possible to obtain a self consistent picture of the universe. Stars appear to have a similar nature to that of the sun, though some seem to be intrinsically much brighter and others much fainter. They appear to be very far from us and from each other, the nearest to us having a distance of about 300,000 times the distance of the earth from the sun. In spite of these large distances one can in certain cases directly measure the apparent diameter of the images of stars seen from the earth; if one then calculates the surface brightness the result then agrees with what would be expected according to what is called the theory of stellar atmospheres. Other predictions made by this theory as well as by other theories are also very successful. The sun and very many stars appear to belong to a very large system called the galaxy, which besides stars contains more diffuse matter between the stars. There appear to be very many galaxies in the universe; galaxies which are far apart from each other appear to be receding from each other, and this general 'expansion of the universe' is supposed to have started in a 'big bang'. In spite of the large amount of speculation in astrophysics, one obtains a very consistent picture based on many observations, and which must have a certain significance. It is far from clear that one can, as is often done in anthroposophical circles, refuse these conclusions of modern astronomy because one does not agree with the large values of the astronomical distances determined!

If one believes these conclusions, it is hard to see much significance for Man in the universe. He appears to be a small creature on a small planet, revolving like other objects of the 'solar system' around an ordinary star in an unexceptional place in the cosmos. Indeed researchers often speak of a 'Copernican principle', according to which the earth is not in a special place; one might consider it very unlikely that humans should be in such a place. It must however also

be mentioned that certain researchers speak of an 'Anthropic principle', according to which the universe must have certain properties (the value of the constants of physics for instance cannot be arbitrary), because otherwise life and observers intelligent enough to study the universe could not exist.

The question now arises as to whether other self consistent pictures of the universe might be equally true. In some of these pictures Man might be significant, and some of the conscious beings behind the phenomena of the cosmos might be shown to have a special relationship with Man.

There indeed exist some preliminary indications that pictures in which Man is significant, may be true. If one studies the positions of certain bright stars in the sky, their positions do not appear to be random. In particular the bright twentieth century novae seem to be in regular positions in the sky (A nova is a star whose brightness as seen by the human eye, increases suddenly by a factor of very often more than 10,000, before fading again to its previous brightness, and which appears to eject a large amount of gas during its brightening). The brightenings of these novae, which appear to be at different distances from us, could only have been observed at certain times in certain positions in the sky, from near the solar system. This is because the light from these stars should take many centuries to reach us. If the regularities of positions in the sky are not due to chance, that is to a statistical effect, another picture of the universe of the sort discussed here would probably be true. Though impressive, it is hard to prove statistically that the regularities are really significant. It is for this reason that the present author has tried to make predictions concerning the positions of future novae, on the basis of the regularities. (See page 21)

If such a type of regularity is significant, this means that beings can act through physical phenomena which appear to be widely separated in space, and hence that spatial separation is in a certain sense an

illusion, or to use an eastern term, Maya. It should be pointed out that effects are known in quantum mechanics which do not appear to only come from one part of space. In addition if the regularities are real, they may be compared with the regularities of waves in quantum physics, and with the regularities of living organisms. The present regularities may not be at the same level as those produced by the quantum theory; one might for instance imagine them less 'necessary' and hence obeyed less often. They might obey an 'aesthetic principle' of the beings associated with them.

Many more researches in this field need to be done. In particular other regularities need to be looked for. Even if what has already been found was not significant, other regularities could be.

## 5.

### The world of pure ideas

The question as to whether ideas are real has often been debated by philosophers since the time of Plato, according to whom they are the basic reality. In the middle ages, the nominalists considered that general ideas were only names, and they were precursors of present materialistic thought on this subject.

Following the reasoning of this article, let us assert that if general ideas are real, one might expect them to be associated with beings having a kind of 'consciousness'. Such a consciousness should show itself by something which other beings cannot control, by something which they cannot grasp. In the material world, this article has reasoned that what cannot be grasped in other beings shows itself as indeterminacy to a being who has dealings with them. It will now be asserted that something similar also exists in the world of pure general ideas, and that they may also possess a kind of 'consciousness'.

Good examples of pure general ideas are those of mathematics. Numbers for instance can be used to measure many different kinds of

thing. Mathematics is often thought to be the prototype of what should be rational thought. What is determinate is determined very often by the laws of mathematics. Now it is very curious that mathematicians have had a lot of difficulty in establishing a logical foundation for mathematics. Indeed it is now known that limits exist in what can be done in this field. One of the most surprising discoveries of the twentieth century was made by K. Gödel, who showed that all the properties of whole numbers cannot be deduced from a finite number of axioms. This means that one cannot base the arithmetic of whole numbers on a finite number of hypotheses. Thus even whole numbers, which might be considered among the simplest and most basic objects of mathematical study, have something which no mathematician can ever grasp! This therefore suggests that a kind of 'consciousness' may be associated with whole numbers, and with the other objects of mathematics based on them (including other types of number such as fractions and irrational numbers).

Occultists have often been interested in the occult significance of numbers, in what might be called their qualities. The father of the present author studied what he called 'qualitative mathematics', and a book containing only a part of his results on the symbolism of numbers was published by the Europa Verlag, Vienna, Austria, a few years before 1970. In his work he compared numbers to human beings: certain properties could be compared with the transformation undergone by a human being from one incarnation to the next. Now if there is a kind of consciousness somehow associated with numbers, not only can one understand the validity of this kind of comparison, but also the presence of all the other qualities studied by the present author's father. However it is clear that much remains to be done to demonstrate and further apply these considerations.

Non mathematical general ideas probably also cannot be fully grasped. Let us recall the difficulty of defining completely the meaning of many



words in a dictionary. Limits to logic may be produced because of a kind of 'consciousness' associated with ideas.

## 6. General considerations.

This article has tried to show that conscious beings are present everywhere in the world, and agrees with a basic idea of Rudolf Steiner. These beings have different natures depending on whether they are associated with 'dead matter' (those beings appear for reasons given above to be fallen), life, the cosmos, and ideas (if the reasoning suggesting a 'consciousness' for ideas given in section 5 is accepted). The reasoning is in many places only preliminary; much more needs to be done either to confirm or to disprove the conclusions. In any case if this approach is fruitful, it is necessary to go much further.

Other authors besides those mentioned in section 2 have tried to find something spiritual in the nature of the world, as deduced by modern science. They have often been influenced by the ideas of eastern philosophy. For instance F. Capra in *The Tao of Physics* concludes that the universe is a unity where all is linked; the results of physics according to him agree with the independently derived eastern ideas. The approach of the present article is different: the emphasis is on the existence of different beings.

In the world different beings have

'social' relations with each other, and for Man the question is not only what relations he should have with fellow humans, but also what relations he should have with other beings. Left wing critics of present day science in the British Society for Social Responsibility in Science said that "Science is social relations"; this is true if one does not only consider the role of science in society, but also relations with non-human beings. If the conclusions of this article are accepted, the aim of Man should not be to exploit other beings, but instead to have correct relations with all including those of the world of ideas; in other words one comes to an 'ecological' conception of what should be Man's role in the world. Science is then a means for understanding these beings; this should be its aim.

'Primitive' man believed himself to be surrounded by beings; he was at least often 'animist'. What are probably degenerate forms of this belief still survive in Africa. Perhaps later Man became polytheist, worshipping a limited number of gods. He then became monotheist and worshipped only one god, while now he is often atheist, believing that no god exists. This may be understood as a progressive separation from a direct awareness of these non-human beings; in the same way as when one is far away from a mountain one only sees its general outline, if one sees it at all, while when one is near one sees individual trees on it. May a spiritualized science help to bring us

closer to the mountain!

What has been said about relations with non-humans is also relevant for human society. At their present stage of development human beings have often very different aims from each other; what is attractive to one is not attractive to another. One human being often tries to limit the knowledge or the ability to act, or both, of the other. In human society knowledge tends to become culture, and the ability to act, the life of the economy. Between the two the state is supposed to decide what is most attractive for the community. In view of these conflicts it is easy to conceive that culture and the economy can best develop when they have as much autonomy as possible from each other and from the state. In this way a new justification for Rudolf Steiner's threefold social order can be given.

No being is alone in the world, so science, like art and religion, is a means of bringing different beings together. May this be our aim!

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(This article was received in June 1984, and we regret the delay in publication. It appeared in *Elemente der Naturwissenschaft* No.41, 1984. — Ed.)

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# News

## Genetic Manipulation: Voluntary Guidelines

The release of genetically engineered organisms into the environment, in the U.K., is now subject to voluntary guidelines issued by the Health and Safety

Executive. The Advisory Committee on Genetic Manipulation, which drew up the guidelines, hopes that they will become obligatory. Scientists are asked to consider the

length of survival of the altered organisms in the open and to make contingency plans in case of "unanticipated effects".

(Ref: *New Scientist* 24th April 1986)

# Anthroposophical Science with special reference to Capillary Dynamolysis

Agnes Fyfe

The question arises: What is anthroposophical science, and how does it differ from orthodox science? Steiner himself gives the answer.

"When we pursue science in the manner of academic scholarship, we are not fulfilling our obligation. We must regard everything that we can learn about the laws of natural phenomena and the laws of the manifestations of the life of the soul as though it were a language which is to lead us to revelation of the divine-spiritual. When we are conscious that all physical, chemical, biological, physiological, psychological laws must be related to something spiritual that is revealing itself to us, then we are fulfilling our obligation."<sup>1</sup>

This statement confronts us with further difficulties. How are we to recognize the spiritual, how does it reveal itself in the physical substances with which we experiment? We turn again to Steiner to find the link.

"This after all is the peculiarity of all that we have on earth: the spiritual must always have physical carriers. Then the materialists come, and take only the physical carrier into account, forgetting the spiritual which it carries. And they are always in the right—for the first thing that meets us is the physical carrier. They only leave out of account that it is the *spiritual* which must have a physical carrier everywhere."<sup>2</sup>

As stated later on the same occasion, it is the ethereal or formative forces that are carried by matter. These forces are active in, or from, the lowest region of the spiritual world.

The search for the workings of these forces in matter calls for new and more sensitive methods than

those generally in use.

*Capillary dynamolysis* is such a method. It was developed by Lili Kolisko from suggestions Steiner gave her for the purpose of studying the workings of the formative forces in plants.<sup>3</sup>

The test is carried out as follows:

1. A volume of sap suited to the size and texture of the filter-paper used is set to rise by capillary absorption. The paper should always be used with the stronger capillaries in the same direction.
2. When the absorbed sap is dry, a metal-salt in solution, that serves as a reagent, is set to rise through it.

This procedure results in a coloured picture of more or less complex design.

The test clearly results from the chemical and physical processes that take place as sap and metal-salt reagent spread to cover a large area of the filter paper.<sup>4,5,6,7</sup>

The task is to find how the formative forces come to expression by these means—to recognize how they manifest in the substances of the plant sap.

1. When chemical reaction takes place instantly, for example during immersion of the paper, it produces uniform colour.
2. When chemical reaction takes place gradually during capillary absorption differentiation appears, either in intensities of one colour, or in a variety of coloured, outlined areas that give more or less complex design or formation.
3. The same type of formation appears, but in different colouring, when the same sap rises in parallel tests with different metals-salt solutions (Plate 1) or even with

aqua dest. as reagent.

4. Different species of plant, when picked simultaneously, produce variations of the same type of form (Plate 2). The colouring alone is very distinctive, in accordance with the different chemical reactions.

The capacity to produce the same type of formation, in spite of different chemical reactions, can only come from some power in the plant saps that 'directs' the flow of the liquids set in movement by the capillary absorption. This power overrides obstacles: a circular hole about half an inch in diameter, or a series of vertical slits cut in the paper, caused some local distortion, but did not alter the general formation of the finished tests.

## Repeatability

### 1. Single tests.

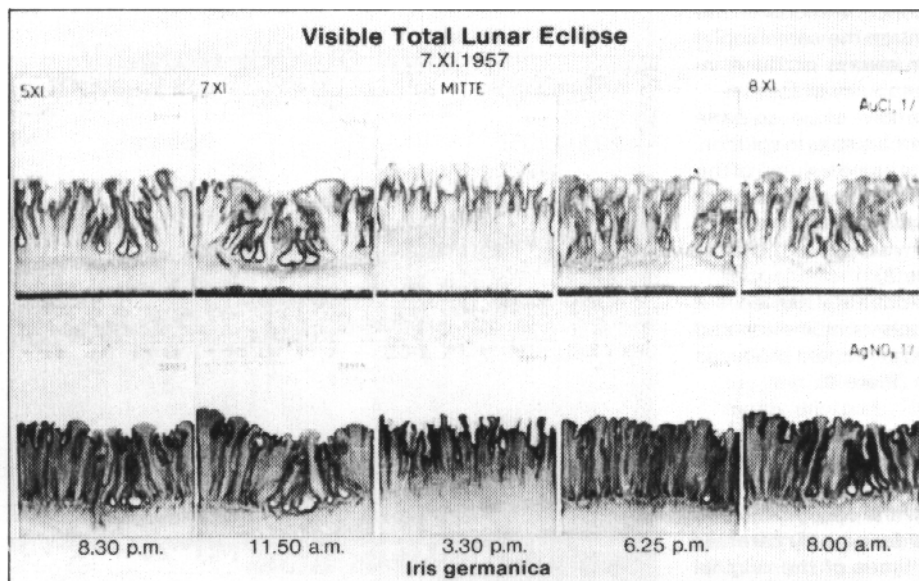
When the physical and chemical properties of liquids are constant, as is the case with chemical solutions of inorganic salts, identical results can be obtained, as Runge (1795-1867) using a quicker procedure and smaller quantities, demonstrated<sup>5</sup>. His results can be repeated today.

When, as with fresh plant saps from different harvests, neither the optical density, viscosity, acidity, intravenous toxicity, chemical analysis is constant, it stands to reason that the test pictures they produce must also vary.

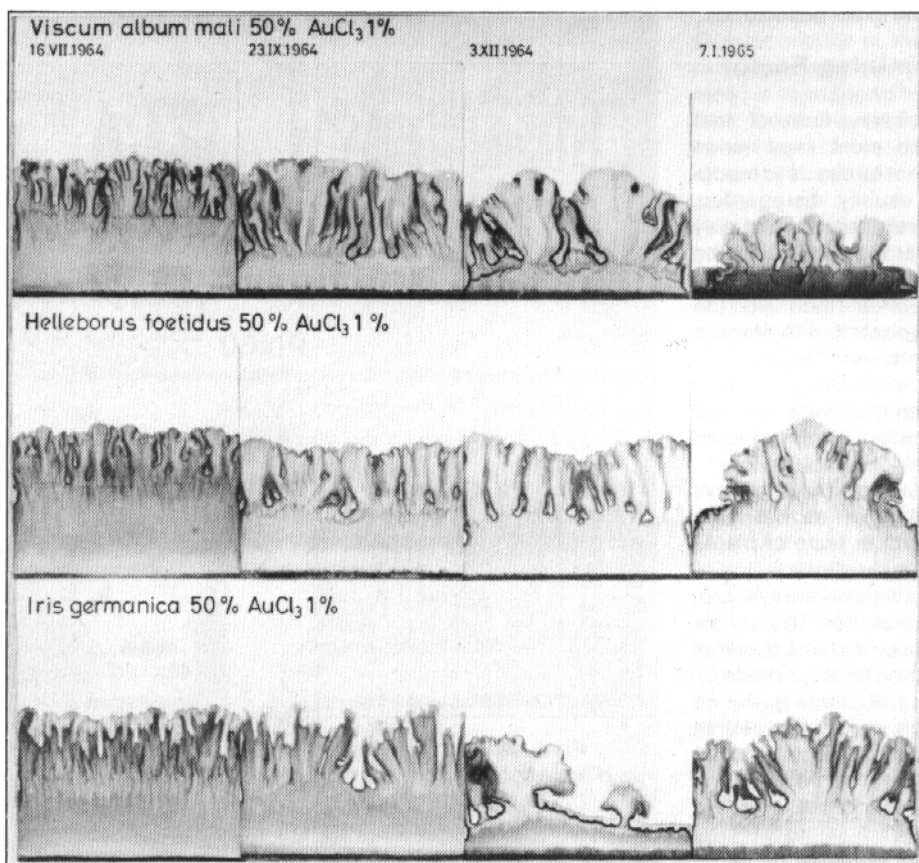
The pharmaceutical industry, well aware of the variability of fresh plant saps, avoids the difficulty by synthesizing the essential ingredients of medicinal plants, thus providing some of the means for chemotherapy, as for instance vitamin tablets.

### 2. Procedures.

Repetition of the same procedures always produces the same effects.



**Plate 1.** The same saps in parallel tests with the gold and silver reagent produce similar formation in spite of different chemical reactions.



**Plate 2.** Three species of plant, picked simultaneously, produce similar formation with the gold reagent, again in spite of different chemical reactions. These give distinctive colouring.

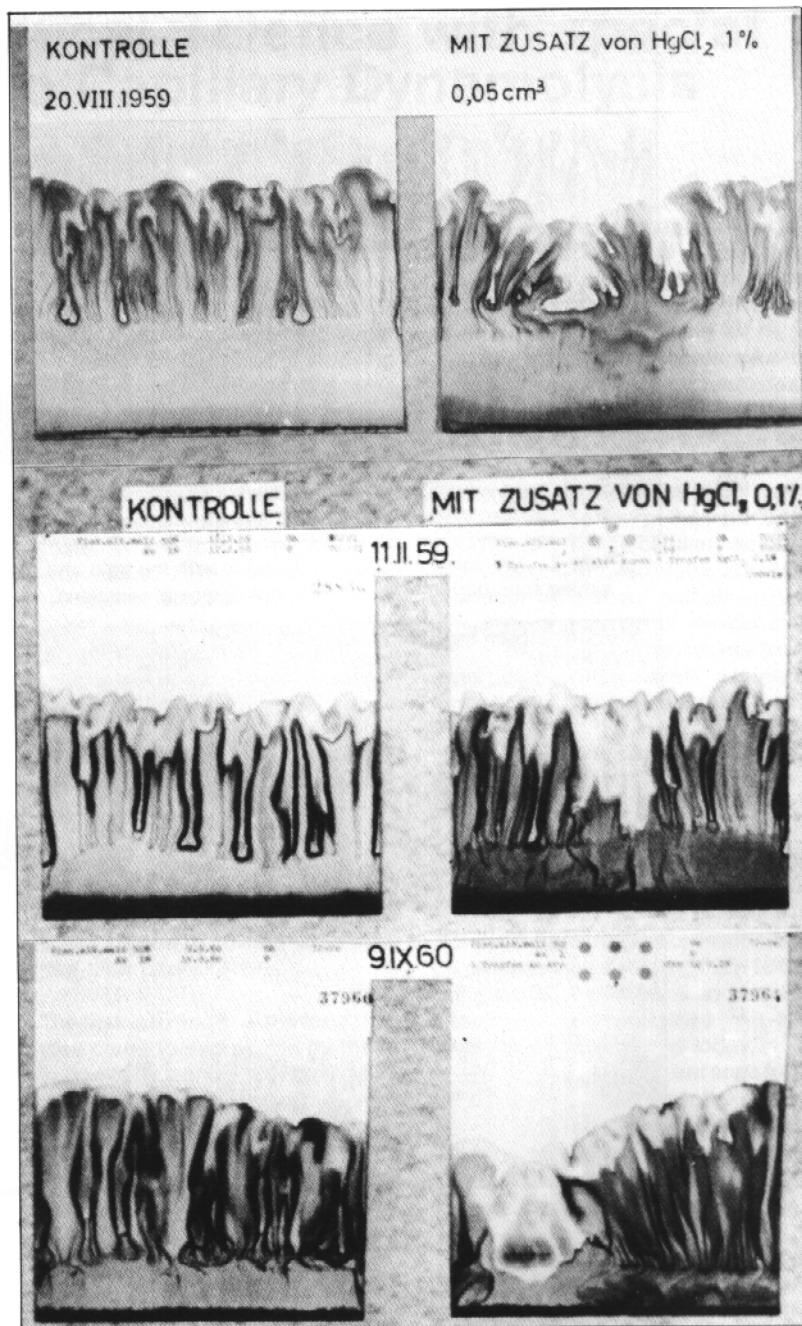
- a. Increasing concentrations of the silver reagent on the same sap in *parallel tests* always produce increasing complexity of form.
- b. The substitution of a suitable volume of mercury salts in solution, ( $\text{HgCl}_2$ ) for the same volume of the gold reagent produces some variation of concave form and amethyst colouring—in rare cases the latter alone.<sup>6</sup> (Plate 3).
- c. The same procedure carried out with any copper combination and the gold or silver reagent produces convex form (Plate 4).

Results obtained by these procedures can be repeated, and unique pictures that appeared 'spontaneously' imitated.<sup>6</sup> (Plate 5). It is only possible to do this by considering very carefully the harvesting times of the original plant and of the one that should give the repetition. Needless to say, this needs years of practical work combined with constant and exact observation.

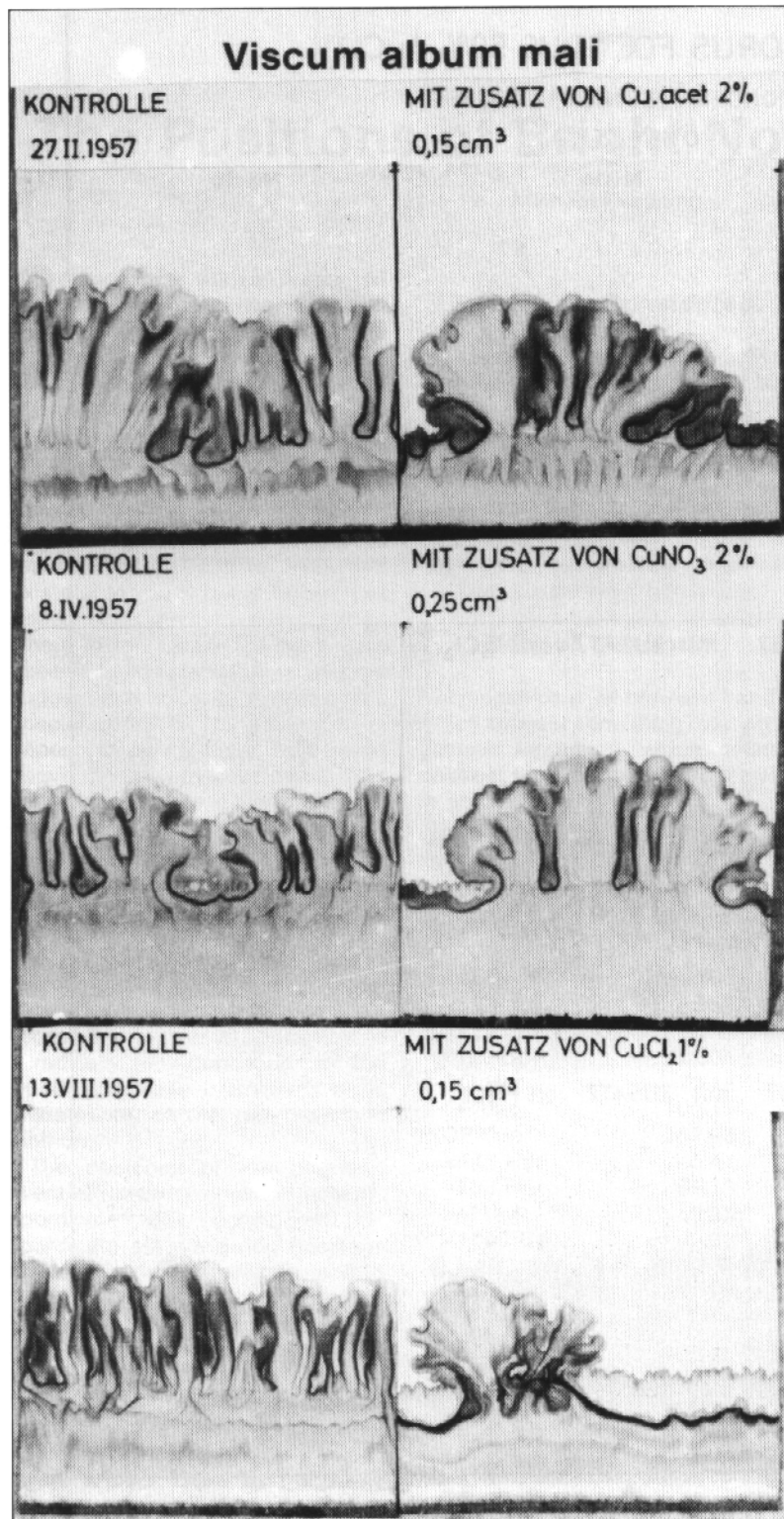
### The Determining Factor

The fact that every form of test applied to fresh plant saps varies with every harvest forces us to recognize a factor usually disregarded, namely *time*. Every test is valid only for the particular moment when the plant was taken from the soil of the earth.<sup>4</sup> Time—other than on the clock—never repeats, but rhythms in time do. For instance:

- a. Total solar eclipses always produce picture series that show *reduced* form in the tests of plants gathered during the middle of the eclipse.<sup>4</sup>
- b. Annular solar eclipses always produce picture series that show *increased* form in tests of plants gathered at mid-eclipse.<sup>4</sup>
- c. Total lunar eclipses always produce picture series that show *reduced* form in the tests of plants gathered during totality.<sup>4</sup> (Plate 5)
- d. Picture series of plants gathered often enough during the course of constellations of the planet Mercury always begin and end with tests that show *concave* form.<sup>6</sup>
- e. Picture series of plants gathered often enough during constellations of the planet Venus always begin and end with tests that show



**Plate 3.** The addition of  $\text{HgCl}_2$  to the gold reagent gives variations of concave form.  
*Upper row:* *Iris germanica*.  
*Lower rows:* *Viscum album mali*.



**Plate 4.** The addition of any copper combination to the gold reagent gives variations of convex form.

convex form.<sup>7</sup>

- f. Planimeter measurements show that the annual graphs of the relative areas covered by certain plant saps and by the copper reagent applied to them repeat in 8 year rhythms.<sup>7</sup>
- g. Such measurements, applied to experiments with the same saps and the mercury reagent reveal four shorter rhythms.<sup>6</sup>
- h. At predictable times certain plant saps fail to develop the test. Saps in 50% concentration that develop the test often fail to do so when highly diluted.<sup>8</sup>

The observations reported above are based on daily experiments carried out for 25 years. They could not have been won in a season or two working with one plant, or parts of it, and one metal salt reagent.

### Summary

Organic matter in the form of fresh plant saps is found by capillary dynamolysis to respond to the course of time. This is the medium in which the lowest form of the spiritual world, the ethereal, manifests.

Capillary dynamolysis, an anthroposophical scientific method, goes further than academic science does, but no further than the proponents of the latter can accept, though not understand.<sup>9</sup>

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# The Positions of Bright Novae in the Sky

Michael Friedjung

Relationships will be presented whose significance, from the statistical as well as from other points of view, is far from certain. If significant they could however suggest an entirely new conception of the world. The question which will be asked is whether the positions in the sky seen from the solar system, of objects which appear bright to the human eye, are regular. It will be suggested that this type of regularity of position exists at least for bright novae. The relationships are very dependent on where in the galaxy the novae are observed, and if statistically significant suggest that the solar system is in a special position. The relationships appear to be different from more conventional physical laws, and might even suggest a type of 'artistic' principle at work, used by conscious entities (certain results of modern physics such as the Heisenberg uncertainty principle suggest consciousness even in 'dead' matter). The interest of considering novae in this connection is that one can transcend the uncertainties of statistics, especially if one wants to demonstrate a radically new conception of the world, and make *predictions* as is characteristic of the true scientific method.

The positions of the brightest twentieth century novae in galactic coordinates will be considered. This coordinate system giving positions of stars in the sky was revised in 1958, and now defines positions fairly accurately with respect to the great circle corresponding to the galactic plane, and with respect to the direction of the galactic centre. This appears to be the most appropriate coordinate system, as novae appear close to the Milky Way (direction of the galactic plane), but it is possible that relationships exist in other simple coordinate systems.

## The Novae Considered.

In Table 1 the characteristics of twentieth century novae with maximum magnitudes brighter than 4.0 are given. The galactic longitude  $l$ , the galactic latitude  $b$ , the Julian date of maximum brightness  $t$ , and the (generally visual) maximum magnitude  $m$ , have been tabulated.

## Relationships between Galactic Longitude and Date of Maximum.

Relationships exist between  $l$  and  $t$ , which suggest something rotating in galactic longitude, which defines positions at which novae are observed to occur.

Firstly taking the bright novae with  $m$  brighter than 2.5 (and particularly between 1918 and 1942) 5 out of 8 rather accurately obey:

$$l = 245.98 + 6.51145 \times 10^{-2}(t - 25000)$$

The accuracy can be seen from Table 2. This will be referred to as the first rotation relation.

If the remaining novae of Table 1 are examined, they appear in nearly all cases to very approximately obey a second rotation relation. This can be defined by the values of  $l$  and  $t$  of RR Pic and V1500 Cyg. Both these novae have  $l$ 's near  $90^\circ$ , which as will be seen below may perhaps be considered significant. The relation then is:

$$l = 279.03 + 9.674 \times 10^{-3}(t - 25000)$$

Table 1.

Nova	$l$	$b$	$t$	$m$
GK Per	150.95	-10.11	15439	0.2
DN Gem	184.01	14.70	19476	3.5
V603 Aq	33.16	00.84	21755	-1.1
V476 Cyg	87.37	12.42	22561	2.0
RR Pic	272.36	-25.67	24310	1.2
DQ Her	73.16	26.44	27794	1.4
CP Lac	102.14	-00.84	28340	2.1
CP Pup	252.92	-00.84	30675	0.2
V446 Her	45.41	04.71	36998	3.0
V533 Her	69.19	24.27	38060	3.0
HR Del	63.43	-13.97	39837	3.5
V1500 Cyg	89.83	-00.08	42656	1.8

It may be noted that only classical novae are considered in Table 1. Therefore the recurrent nova T Cor Bor is not included.

Table 2.

Nova	Predicted $l$	Observed $l$	Deviation
V603 Aq	34.68	33.16	1.52
V476 Cyg	87.17	87.37	-0.20
DQ Her	427.91	433.16	-5.25
CP Lac	463.46	462.14	1.32
CP Pup	615.50	612.92	2.58

The much lower accuracy of this relationship can be seen from Table 3. Amongst the few bright nineteenth century novae known, Q Cyg may also be considered as obeying this relationship.

### The Values of Galactic Longitude

The values of  $l$  of nearly all the novae of Table 1 and a few others appear to fit a relation which may be connected with what is discussed above. The natural logarithms of  $\sin l$  will be taken, and divided by the value of this natural logarithm for CP Lac. The result is shown in Table 4.

Where the suffix \* follows,  $\text{Ln } \sin l$  is negative, and the natural logarithm of the modulus was taken. The ratios are close to integers i.e. within 1/15 of an integer.

This relation appears at first sight to be perhaps significant for more than one reason. Firstly the division is not by an arbitrary number, but by the smallest value of  $\text{Ln } \sin l$  which can give a large number of fairly small ratios (for example 5 with values between 2 and 5). Secondly there appears to be a connection with the rotation relations. If the very bright novae of the first rotation relation are taken in order of appearance as in Table 2, one obtains for the 5 novae:

relation not obeyed

ratio = 0

ratio = 2

ratio = 1

ratio = 2

Therefore particularly small integers occur in an almost regular sequence. In the case of the novae of the second rotation relation one similarly obtains:

ratio = 32

ratio = 0

ratio = 15

ratio = 3

ratio = 5

ratio = 0

These ratios vary in a rather less simple way. It may be noted that the two novae of Table 3 with ratios near zero were used to define the second rotation relation.

If all the novae mentioned in Table 4 are considered, there may be a tendency for fainter novae to have larger ratios, this being particularly true if the ratio of GK Per is taken to

Table 3.

Nova	Predicted $l$	Observed $l$	Deviation
Gk Per	186.54	150.95	35.59
RR Pic	-	272.36	-
V446 Her	395.09	405.41	-10.32
V533 Her	405.37	429.19	-23.82
HR Del	422.56	423.43	-00.87
V1500 Cyg	-	449.83	-

Amongst the few bright nineteenth century novae known, Q Cyg may also be considered as obeying this relationship.

Table 4.

Nova	$\text{Ln } \sin l$	Ratio	$m$
V476 Cyg	-0.00105	0.047	2.0
RR Pic	-0.00085*	0.038	1.2
V1500 Cyg	-0.000004	0.0002	1.8
CP Lac	-0.02262	1	2.1
DQ Her	-0.04383	1.938	1.4
CP Pup	-0.04511*	1.994	0.2
V533 Her	-0.06746	2.983	3.0
HR Del	-0.11161	4.935	3.5
LV Vul	-0.11275	4.985	5.2
V446 Her	-0.33947	15.009	3.0
GI Mon	-0.38404*	16.980	5.6
FH Ser	-0.61006	26.973	4.5
GK Per	-0.72243	31.941	0.2
CT Ser	-0.88098	38.952	5

Table 5.

Nova	Ratio
GK Per	23.934
V446 Her	76.029
V533 Her	40.088
HR Del	185

be one of the few chance cases one may expect of the relation being obeyed. Also one might consider that the integral ratio relation is valid for the novae of Table 1 observed from 1920.

The values of  $\text{Ln } \sin l$  (deviation from second rotation relation of Table 3) can also be taken and divided by  $\text{Ln } \sin l$  of CP Lac. The result is shown in Table 5. It therefore appears that integral ratios can also occur here.

It may finally be noted that attempts have been made to find other relationships for the galactic longitudes of bright novae. A perhaps somewhat artificial relation was noticed, which involved the novae of the second rotation relation. The time between nova outbursts and the date when this relation gave a longitude of  $360^\circ$

=  $0^\circ$ , seems often to be a simple fraction of the binary period of Sirius, the brightest star. However not very much weight should be given to what is probably an effect of chance.

### Other Relationships of Bright Novae

The galactic latitudes  $b$  of Table 1 do not appear to be uniformly distributed. Though nothing as spectacular as the relations for galactic longitude appears at first sight, the values of Table 1 suggest clustering. If one takes the means of the values in each cluster not taking into account the signs, one has:

$$(0.84 + 0.84 + 0.84 + 0.08)/4 = 0.65$$

$$(10.11 + 12.42 + 13.97 + 14.70)/4 = 12.80$$

$$(24.27 + 25.67 + 26.44)/3 = 25.46$$



All the  $b$  values of Table 1 except that of V446 Her (4.71) are included in these means. Then the ratio  $25.46/12.80 = 1.989$ , not far from 2.

It is possible also that simple ratios exist between the orbital periods of these bright novae observed long after their outbursts. Unfortunately these orbital periods of the novae, considered as binary stars, are not known in many cases, and it is difficult to draw final conclusions.

### Discussion

The relationships presented here are rather strange from a number of points of view, and most astronomers would consider them probably due to chance. The positions as seen from the solar system are involved, and the sun (which in any case is not a nova) is thought to be a fairly normal type of star. In addition the novae are at different distances; for instance light from HR Del would take about 3000 years, while that from V603 Aq

would only take about 1200 years to reach us. It is therefore hard to see how physical causes could connect novae from which light near outburst maximum arrives at similar times.

Approximate calculations suggest that the relations involving  $l$  may be statistically significant. However it is very hard to prove anything by a *posteriori* statistics, as one may always suppose that many other types of relation are possible. Those presented here are very simple but the only way to prove anything is to make predictions. The cause of the first rotation relation for  $l$  seems to have finished after 1942, but one can attempt predictions using the second rotation relation and that involving ratios of  $\ln \sin l$ . An attempt was made to predict novae, using probable integers for these ratios (see appendix). The future will tell whether this approach is fruitful. . . .

Modern astronomy and astrophysics lead to a consistent picture of the world in spite of the speculations

which abound in more theoretical domains. For instance it is not easy to change very much the stellar distance scale. However, the world which appears to surround us is 'Maya', the great illusion, and certain phenomena such as those discussed here may pierce this illusion. More than one picture of the world may be needed to explain what we observe. The relations described here, which slightly remind one of relations in atomic physics, may penetrate to a more hidden level of reality.

### Note

Various future researches can be proposed. One might be able to connect the relationships shown here with the physical characteristics of novae such as the speed class (which gives the speed of development of a nova after maximum light, when it is fading in light to which the human eye is sensitive).

November 1983

## Appendix

### Prediction of possible positions in the sky of future bright novae

Novae with maximum visual magnitudes  $<4.0$  may occur in the next ten years in particular at the following positions:

between galactic longitudes 110.6 and 111.1 probably before September 1988		
113.8	114.2	August 1989
116.5	116.9	May 1990
119.0	119.4	January 1991
121.2	121.6	September 1991
123.3	123.6	April 1992
125.2	125.5	October 1992
127.0	127.3	April 1993
130.2	130.5	March 1994
134.5	134.7	May 1995

The basis of these predictions would appear very improbable according to present astronomical knowledge, so the predictions are presented by themselves for the present.

# Holistic Science

Hedley Gange

**H**olistic trends in science, and in other spheres, have been developed and discussed during the last few decades. The idea of a holistic approach owes much to a belief in the unity of knowledge and of the values underlying human experience. The term 'holistic science' is here interpreted broadly as including systematic studies in the aesthetic and moral spheres, as well as aspects of exact science.

A review of the history of the last fifty years indicates that there have been two inter-related paths of development: one the pursuit of the spiritual science of Rudolf Steiner, based on the Anthroposophical Society; the other, wider and more diffuse, arising out of what has become known as the holistic movement.

It may serve a useful purpose, and help to co-ordinate future progress, if these two paths (referred to, for convenience, as the 'anthroposophical' and the 'holistic'), their common interests and distinctive characteristics, can be made more clearly recognizable. A tentative indication of some of the elements capable of contributing to a future 'holistic science' is given below.

● **Orthodox Science** Much of the method and content of orthodox science can be of value from the holistic standpoint—for example, where the treatment is phenomenological or descriptive.

● **Mathematics** is of special interest—for operational purposes, as a cultural study and for its spiritual or occult aspects.

● **Extensions or reorientations of the scientific method.** Rupert Sheldrake's concept of formative causation provides one example of an 'extension' of the customary scien-

tific approach. David Bohm's work represents an extension of the conventional approach to the question of causality in physics. A reorientation of the scientific method is proposed by Fritjof Capra in his book *The Turning Point*. A rather different and more comprehensive reorientation is expounded by Ernst Lehrs in *Man or Matter*: this is based on Goethe's method of training observation and thought and is inspired by the work of Rudolf Steiner.

● **Music, Speech, Dance.** These are of fundamental cultural significance. They may appear in religious, artistic, therapeutic or social contexts. Their influence may help to heal and unify in circumstances where problems exist at the intellectual level.

● **Moral factors** in science and in contemporary life. These are of wide interest and concern in connection with, for example, genetic experimentation, surrogate motherhood, the computerised society, etc. Questions of conservation and the use of nuclear energy inspire worldwide movements. There is increasing recognition, in science and in life, that man cannot be regarded as being detached from nature, and that the moral element is one factor in this relationship.

● **Religious, philosophical and other world concepts.** These often involve an ordered, meditative life. Their influence may be direct or indirect. Some social and therapeutic movements have developed from traditional Christianity: aspects of, for example, Chinese philosophy have, in recent times, become incorporated into Western thought. The influence of Christianity in the sphere of science and philosophy appears in the work of Teilhard de Chardin.

● **Schools of medicine, techniques, systems of physical or mental training.** Examples are: orthodox medicine, homoeopathy, acupuncture, Alexander technique, yoga, colour therapy. The degree to which these may be 'unified' or made to serve a common purpose will be dependent, largely, upon the individual practitioner or group.

● **Complementary approaches.** The holistic movement brings together varied interests and experiences. The availability of relevant information from a wide range of sources, coupled with a prior interest in a holistic approach, provides favourable conditions for progress. In the first instance, this may consist simply of choosing the most suitable method or technique from a store of alternatives. In other cases, different fields may become mutually inter-related, for example, surgery and psychotherapy.

● **Esoteric studies.** Interest in esoteric studies has been growing during the last few years. Different cultures and spiritual streams bring their esoteric elements into the holistic movement.

● **New forces and phenomena.** There is an extensive literature dealing with unexplained phenomena, 'fields of life', orgone energy, spiritual healing, etc. Renewed interest in some of these subjects has arisen recently, following the inauguration of a Chair in Parapsychology at Edinburgh University in accordance with the terms of the Koestler bequest. Anthroposophical studies of etheric and other forces can be of interest and value in this field.

● **Planetary, zodiacal and other cosmic influences.** These are of both specialist and popular interest

today. Studies have been made from various standpoints, including those of orthodox science, ancient and classical legends, religious systems, cosmic rhythms in relation to human life, man as microcosm, the stars and human destiny, etc. Some modern investigators have sought to create a new synthesis out of ancient wisdom and the results of modern scientific and scholastic research. The synthesis is assisted by the current recognition

of the limitations inherent in the present scientific method combined with renewed interest in spiritual knowledge and practices. A very wide field opens up as different cultures, disciplines and schools of thought make their own contributions. Many common threads are discernible. There is today an increasing readiness to consider that forces at present unknown to science may be at work in man and nature.

## Future progress

The degree to which the above elements can develop into a cohesive whole remains to be seen. There are many difficulties. Some progress has been made, and there is promise of further progress in the future. The inter-relationship between the 'anthroposophical' and 'holistic' paths will, of course, continue to be a matter of vital concern.

# A Periodicals Reference Data Base for Goethean Science

William Steffen

Over the past thirty years a considerable body of research, undertaken by Goetheanistic authors, has been published in a variety of journals. Most of this material is in German and, in my experience, is largely untapped outside a small number of German-speaking scientists. This is even more true in non German-speaking countries where copies of the relevant periodicals are often difficult to obtain or borrow.

This situation has led me to set up a computerised periodicals reference data base for Goethean science here at the Botton Science Laboratory, using the versatile management data base system DELTA™ by the London-based software company CompSoft Ltd. The data base specifically contains articles in periodicals or in books which form collections of individual articles by different authors. The data base is *not* set up for and does *not* hold books, written as a whole by a single author or a group of authors.

The data base currently holds the following serials (March 1986):

**Elemente der Naturwissenschaft** 1964-1986, Dornach  
**Science Forum** 1981-1986, London  
**Mitteilungen des C.G. Carus-Instituts** 1967-1986, Oeschelbronn  
**Referate der Anthrop. Pharmaz. Arbeitsgem.** 1974-83, Stuttgart  
**Tycho-de-Brahe Jahrbuch** 1984-1985, Stuttgart  
**Goetheanistische Naturwissenschaft** vol 1-4, Stuttgart

**Erscheinungsformen des Aetherischen** Stuttgart.

**Reports Max-Planck-Institut für Strömungs'g** 1974-82, Göttingen\*  
**British Homoeopathic Journal** 1980-1986, London\*

selected articles from various other journals.

\* *selected items only*

I plan to include the following items in the near future:

**Mathematisch-physikalische Korrespondenz**, Dornach  
**Mathematical-Physical Correspondence**, USA

Selected articles of **Die Drei** Stuttgart

A broadening out into agriculture and medicine would be possible in the future if such a need is felt. Another development could be the setting up of a data base for books on Goetheanistic science.

Each article is indexed in relation to a specifically defined set of subject headings. Lists of the latter in English or German are available on request. The data base can be searched for any of the following headings:

author  
title (or specific words in the title)  
periodical, volume, issue number, year  
subject headings

or any combination of these logically linked by *and* or *or*. The selected items can then be sorted in a variety of ways and printed out in an appropriate format.

The data base currently holds

about 500 titles and should eventually (with the inclusion of MPK etc) store over 1000 items. I hope that this facility will be used by Goetheanistic researchers, teachers, teacher training courses and anyone interested in a particular field of Goethean science. It may also assist editors in the compilation of indexes etc.

Anyone wishing to access the data base please write to or ring the Botton Science Laboratory. We shall carry out the search according to the customer's request and mail a print-out of the selected items. We also have a telex facility at Botton which can be used both for requests as well as the mailing of results. The service will be free of charge to encourage and facilitate its use.

Most items stored on the data base are held in the library of the Botton Science Laboratory. We are happy to make these available to anyone on a loan basis or photocopy selected items (within copyright regulations) and mail these to the customer.

I hope that this facility will help all those interested in Goethean science to make better use of the considerable contribution to a spiritualised natural science made by Goetheanistic researchers over the past decades.

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# News & Publications

## Science Teachers' Training Course 1986/87

The rapid expansion in the number and size of Waldorf Schools, together with a society that is becoming ever more controlled by technology, is creating an urgent need for trained Upper School Science Teachers. No training course exists at present for those who may wish to take up the work, and so Wynstones School in Gloucestershire is offering a one-year full-time Training Course to help meet this need, beginning in September 1986.

The Course will be built around the question 'How do we meet today's adolescents with a meaningful science curriculum based on spiritual science?' Such a question is a real challenge to those trained in a natural scientific discipline.

The Course will follow the academic year dates of Wynstones (early September to mid July) and will include:

- Curriculum study of Upper School science subjects.
  - Observation of classes (with teaching where appropriate).
  - Rudolf Steiner's Scientific-Lecture courses.
  - Practical Laboratory work.
  - Seminar with Wynstones Upper School teachers and visiting staff.
  - Study of adolescence.
  - Teaching skills (preparation, discipline etc.)
- Perspectives on Natural Science and Spiritual Science.
  - Weekly Painting, Eurythmy, Modelling and Speech.

We are now receiving enquiries for the Course, and if you have a real wish to teach science in an Upper School, have a formal training in a scientific discipline and have made some study of Anthroposophy, then we would be pleased to hear from you and to send you further details.

Please write to: Graham Kennish, Science Teachers' Training Course, Wynstones School, Whaddon, Gloucester GL4 0UF, United Kingdom.

Alan Hall, Ron Jarman, Graham Kennish, Frances Woolls. (Course organisers)

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## Die Drei

*Die Drei*, the monthly journal of the Anthroposophical Society in Germany, covers all aspects of Anthroposophy, and some contributions are of particular interest to scientists. Articles in the January 1986 issue consider Steiner's *Theory of Knowledge Implicit in Goethe's World Conception* in the light of contemporary thought, a hundred years after its first publication. Several items in the February 1986 issue are relevant to matters currently under discussion in the Science Group. The modern significance of Goethe's

characteristic method '*anschauende Urteilskraft*' is discussed by Herbert Witzemann: anthroposophical and conventional approaches to the question of the boundaries of sense-experience are compared by Dietrich Rapp: there is a review of a book on trees and planets by Frits H. Julius and Ernst Michael Kranich (*Bäume und Planeten*, Verlag Freies Geistesleben, 1985) in which reference is made to the structure of the First Goetheanum and to the seven trees: beech, ash, cherry, oak, elm, maple and birch.

Other books reviewed include *Ethik und Mathematik* by Gunter Röscher (Verlag Freies Geistesleben, 1985) dealing with the nature of mathematical thought, especially the ethical element, with reference to the approaches of Cantor, Gödel and Steiner; and *The Organism of the Earth* by Jochen Bockemühl and others (*Der Organismus der Erde*, Verlag Freies Geistesleben, 1985) in which the various contributors discuss aspects of a new, Goetheanistic ecology.

Hedley Gange

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## Publications Received

*The Automobilitic Syndrome*, by Halbert B. Dunn, published by the author, describes how the design and planning of both cities and countryside, in North America, are being determined increasingly by the requirements of the motor car, with, in the view of the

author, detrimental consequences which have not yet been adequately recognized.

*Colour, Illumination and Human Sight in relation to Health*, by Theo Gimbel, Hygeia Publications. An eight page

research paper including a bibliography.

*The Sun: the ancient mysteries and a new physics* by Georg Blattman, Floris Books, 1985. This will be reviewed in the next issue of *Science Forum*.

# Generalisations, Universals and Science

N.C. Thomas

How are general truths discovered? Science has long sought a rigorous method for this, largely unsuccessfully. A method it *does* use is called 'induction'. This method, however, is far from being rigorous. The philosopher Hume's criticism remains devastating: induction cannot be proved without resorting to induction itself! No matter how many times induction as a method may serve us well, to conclude its reliability from that fact is itself an inductive argument.

What exactly does induction achieve, and how is it used? For example, I observe that passing an electric current through a coil of wire generates a magnetic field. Anyone who has performed such an experiment has, to my knowledge, always found this to be correct. Does this *prove* that it will *always* be so? Of course not. How many engineers or physicists seriously doubt it, though? It has been correct so often and reliably that its truth is taken as established *by induction*. In other words, the proposition "on *some* occasions an electric current in a coil produces a magnetic field", a conclusion of little value to an engineer, becomes by induction, "on *all* occasions an electric current in a coil produces a magnetic field"; a conclusion of great value because it may be used to design reliable machines. The vital difference lies in replacing 'some' by 'all'. Thereby a so-called universal proposition is enunciated.

Without universal propositions no deductive reasoning is possible; both classical and modern logic depend upon them for drawing valid conclusions. How are they to be established? Classically they were obtained by revelation, from authority of some kind, or *a priori*. None of these methods is scientific, and the only method accepted in scientific practice

is induction. In view of Hume's criticism we see that science itself is founded on faith.

We will challenge at the outset the necessity for induction. However, universals of *some* kind are essential. Consider a simple proposition such as "some snakes are reptiles". In order to state it we already need two universals, namely the concepts 'snake' and 'reptile'. These are acquired either directly from experience and thinking, or through education. The important points which we shall develop further are that a definite thinking activity is required to form concepts, and that even particular propositions may only be enunciated *after* it has taken place. We see a different approach to universals, namely through concepts rather than propositions.

If I perceive an object unknown to me, I immediately seek to find out what it is: I demand a concept for it. In a new environment I may experience many new entities, and repeated experience of a particular one leads me to form a concept of it. In this way I acquire concepts such as 'chair', 'light', 'pencil' and so on. No concepts would be acquired, however, were I not a thinking being. The *kind* of thinking is important to observe. It is not the exercise of deductive logic, or an analytical process, but a 'synthesizing' process whereby a general concept covering many possible observations is formed from my experience of particular cases. This thinking adds something essential to what the senses provide. It has often been pointed out that nowhere in Nature do we find a perfect straight line, for example, but only approximations. Likewise for circles and other geometric concepts. If these do not exist in Nature, then where do we get them from? It is hardly satisfac-

tory to say that they are 'suggested' by sense experience, for they plainly are not. It is only our *thinking* about Nature that *itself* 'suggests' to us such concepts. These ideal entities are genuine additions to what the senses provide. Of course it is quite possible that I would never form the concept 'circle' without having experienced approximate circles with my senses, but the step from the observation of approximations to the exact concept is crucial. It cannot be made without thinking.

We see, then, that we possess the ability to form general concepts. This ability, I suggest, we also exercise when forming universal propositions. The difference in these two applications of it are very great.

To see this, note that concepts cannot be wrong but propositions certainly may. What I mean is that the concept 'ellipse', for example, cannot itself be 'wrong'. It can be wrongly applied, however. I perceive an elliptical lake, but then find that perspective has tricked me, for on drawing closer I see it is really circular. The concept 'ellipse' was wrongly applied to that particular lake. I do not then discard it as useless for ever after, but note instead my error of judgement! Concepts have a domain of application.

A universal proposition, however, involves a judgement in the way that a concept does not, and it may well be wrong.

Why trouble ourselves at all with propositions? Are not concepts themselves sufficient? At first it seems not, since it is the synthetic judgement involved in a proposition that normally counts as 'knowledge'. That may be tested scientifically because it includes information not derivable by thought alone.

In this connection there has long been a dispute as to the value of syllogisms. Does a syllogism such as;

*All men are mortal  
Socrates is a man  
hence Socrates is mortal*

really convey anything new in its conclusion? It has been argued both ways. The proposition 'all men are mortal' could be seen as one of many possible explications of the concept 'man'. In other words a sophisticated concept could be seen to involve many implied judgements. However, as a *concept* it differs from an explicit judgement in that it cannot be wrong. The concept 'mortal man' does apply to Socrates, but presumably not to the Flying Dutchman. Similarly the concept 'electron' includes many implied judgements concerning its mass, electric charge, spin and so on. As research proceeds those qualities are modified and refined. This does not, however, compel us to abandon the concept 'electron' at each stage. Instead we recognize that our concept is being improved upon, enlarged and refined. In the last resort only the recognition that electrons do not exist could force us to abandon the concept. Even then it would not be 'wrong' but inappropriate to the reality we know. Similarly our concept of a particular person grows and enriches with experience. We may well form a misleading conception initially, because of poor observation or deceit, but once again we then have a concept inapplicable to that person.

I am suggesting that propositions may be replaced by complex concepts. There is then no need to demand their universal correctness, as there would be for explicit judgements. Some concepts will prove more useful than others, obtaining a wide currency. Others will fall out of use. The so-called problem of induction does not arise. I would further suggest that this is in practice what happens. The problem of induction is a paper tiger! The 'generalising' capacity of human thinking has its rightful task in producing concepts that are as accurate as possible, not in producing abstract unprovable general propositions.

What, then, of paradigms, theories,

models and hypotheses? Surely competing theories and models aid research? Are not hypotheses essential as preliminaries to stimulate research? Here we need to discriminate between *techniques* and *knowledge*. It is surely clear that neither unproved hypotheses nor competing theories qualify as knowledge! The research they provoke, however, together with their thought content lead to useful observations and concepts. Our basic conception of gravity, for example, is unlikely to vanish altogether no matter what future research may reveal. Its *law* may be refined and its concomitants more deeply explored. The discovery of anti-gravity might well consist in finding those situations (if any) where the concept of gravity is not applicable. What *will* come and go are the models upon which we drape the concept. Curved space, exchange of gravitons and so on are metaphysical constructs that are not essential to knowledge. They are crutches upon which we lean to help us manipulate the concepts, *for it is very difficult to work with pure concepts*. Try, for example, to think 'triangle' without visualising any actual instance of a triangle. (I do not mean, as I hope is clear from the context, the mere saying of the word 'triangle'). Models serve us, but need to be recognized for what they are. **(But concepts are part of reality; do not lose sight of this).**

Hypotheses and competing theories are techniques which help us to design experiments for sharpening the focus of our ideas. The very words suggest their transitoriness and insecure status. Only when *disproved*, according to Sir Karl Popper, is their relationship to knowledge precise. Otherwise they are supported more or less by evidence. They are not, according to this view, knowledge. However, they may well be useful as a means to improve the precision of the general concepts in terms of which they are framed. Our knowledge is more active than sometimes supposed. It may be seen to reside more in an *ability* to judge correctly what we perceive on the basis of our concepts. This is to be contrasted with the 'storehouse' view that

imagines knowledge to be stored somewhere inside us, suitably accessible, as though in a library. We shift the focus from passive storage to active ability.

It might appear that this view of scientific knowledge in relation to universals is not essentially different from that based on induction. Does not the essence of the question yet lie in the ability to test our knowledge, which must involve the risk of a negative conclusion? Whether I put this in a context of testing propositions—viewing my knowledge as the sum total of accepted propositions—or I view it as my ability to apply concepts to my observations, is perhaps of no great importance?

The view here proposed has two virtues which render it significantly different; the problem of induction as classically conceived does not arise, and the trap of metaphysics is avoided. The former was our starting point but the latter needs further explanation.

Metaphysics is here intended in the way Rudolf Steiner uses it in his *Philosophy of Freedom*; knowledge resting upon an appeal to some unknowable ground of reality. A metaphysical concept of God, on this basis, is a view of God as a Being Who is in principle unknowable, to which we appeal in order to explain our existence. (God need not be conceived of in this way). Materialism may also be metaphysical by making appeal to a substratum which is supposed to explain the sense world and yet is in itself unknowable directly. Scientific atomism is a case in point, for at best our experience of atoms is second hand, based as it is on an interpretation of complex experiments. Non-metaphysical materialism is closer to naive realism which simply accepts the sense perceptible as real.

Rudolf Steiner implies in his *Philosophy of Freedom* that the process of induction entails a metaphysical ingredient. This is because the inductive process attempts to lay hold on laws which are not directly experienced as *such*. If they were there would be no need for induction! For example

the existence of a magnetic field is deduced from the observation of magnetic phenomena. The closest we come to a direct experience is when we hold two magnets and oppose their force of attraction or repulsion. But we *experience* having to exert a force to hold them where we want them, not a field as such. Firstly we conclude by induction that such a force will always be experienced in those circumstances (as a general law) and then we deduce the existence of a magnetic field to explain the law. The law as a *law* is not directly experienced, only its effects in particular instances; still less is the field directly experienced. A law is assumed to be part of reality, and to be the result of the action of a metaphysical construct such as, in this example, a field. The goal of this use of induction is to infer the existence of otherwise unreachable elements of the world i.e. to infer what are necessarily metaphysical ingredients of reality. Were this not the case

there would be no need for induction.

The alternative proposed has no need for metaphysics. Instead of abstract laws it seeks to frame accurate concepts. Those concepts are not supposed to exist in a metaphysical sense. They are the unobservable part of our experience which we reach instead through our thinking capacity. They are not independently real, but an aspect of reality; that aspect inaccessible to observation. They are not metaphysical because they *are* accessible through thinking. This is not the same as to say that metaphysical laws are accessible to our thinking, for we intend thinking to be seen as part of reality itself, penetrating reality itself. In contrast the whole paradigm in which induction is employed treats the thinking capacity differently by assuming that it can do no other than merely picture reality in some way, so that to think a general law is a human activity that is not essential to reality.

Modern physics has found this view difficult to sustain, and David Bohm in his book *Wholeness and the Implicate Order* suggests at the outset that thinking may be part of reality. Rudolf Steiner's view, as espoused here, treats thinking as *that* primary reality which we may first know thoroughly. Refrain from thinking and you refrain from knowing! We saw at the outset that the kind of thinking required to form concepts is the opposite of analytical thinking. That such a capacity lies in us is an empirical fact only to be discovered by observation.

### **Conclusion**

We are freed from materialism by abandoning the supposed metaphysical ground of reality, and our pure concepts may well be part of a reality yet to be discovered. As *concepts* they will still apply. The use of metaphysical models short-circuits our view of reality, shutting out a future recognition of the spiritual as a *scientific ingredient of the world*.



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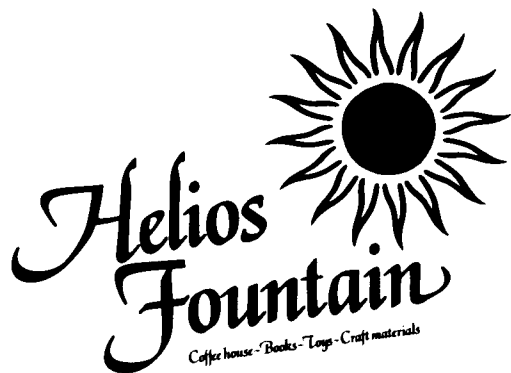
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