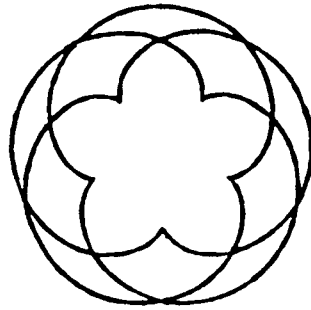


SCIENCE FORUM



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The editors would be pleased to receive such items for consideration (preferably typed in double-spacing). Please address all communications to: Science Forum, c/o Rudolf Steiner House, 35 Park Road, London NW1 6XT

Responsibility for views expressed attaches only to the authors.

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

This issue of *Science Forum* reflects something of the widening scope and interests of the Science Group, touching aspects of astronomy, atomic physics, botany, physiology, optics and electricity. We are grateful to all those who have sent us articles, information and comment. These are always welcome. The correspondence section, particularly, seems to be fulfilling a need: the element of discussion can be especially valuable where concepts and principles deriving from Anthroposophy are being investigated and developed.

Mention of a few of the many more subjects we would like to hear about will, perhaps, stimulate readers to write about their experiences, problems or results: archaeology, evolution in the plant and animal kingdoms, the status of practical techniques, the fundamentals of a phenomenological/quantitative approach in

physics and chemistry, etc.

Many books have been written by anthroposophical authorities in various fields of science. It is not always appreciated that these are usually tentative in part, and, like most other human endeavour, subject to modification with the passage of time. In some cases, a grand scheme has been brilliantly sketched out but needing much additional work for its consolidation, with the possibility of, eventually, a degree of change to the scheme itself. Perhaps this is an area where a new Group may be able to bring a fresh approach along both existing and new paths of investigation!

May we take this opportunity of greeting readers in far-away places; east of Suez, in America, in the antipodes, as well as those in Europe. We are fortunate in having a world-wide language as our medium of communication.

A Lemniscatory Path for the Earth

Martin McCrea

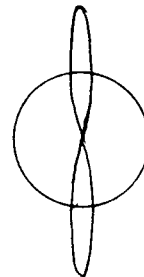
The question of the earth's true or absolute motion seems to be a non-question in the light of modern scientific ideas. With the advent of Einstein's relativity theories any reference framework is considered merely a convenient model, one of an infinitude of equally valid models. Along with this is the quest for the simplest model. In the physical sciences simplicity is the standard of elegance. A model that is consistent with the known facts but which is highly complicated is considered inferior to one which is also consistent with the facts which is very simple. This inward striving for simplicity is one of the main reasons that Kepler's theory of the planetary motions, modified by Newton's gravitational laws, has come to be considered the most elegant picture of our solar system. Within the observable solar system this heliocentric model is quite compatible with the facts, and moreover has the elegance of simplicity. So even though science says 'everything is relative' it treats our solar system as if the reality were a large central body of great mass, the sun, with the planets circling around it in elliptical paths according to the law of gravitation. This is of course taking into account that the sun is also moving in its path towards the constellation Hercules.

There is a certain amount of validity to this approach, and any modifications of this Kepler model of the solar system will have to include within it the relationships of Kepler's laws, for these are purely descriptions of phenomena. What will not have to be included are the explanations that Newton and, later, Einstein gave for these laws via their respective theories of gravitation, for these are examples of what Rudolf Steiner calls metaphysical realism in his *Philosophy of Freedom*. That is, they go out of the bounds of what is directly or indirectly observable, and though they take observable facts into consideration, they are not examples of the kind of thinking which waits and allows the facts to speak for themselves.

In the course of his life Rudolf Steiner made

several statements which appear to contradict the modern scientific viewpoint of the solar system. One was that the sun had no, or negative, mass, and another that the earth was travelling through space in a lemniscatory path. These two statements contradict Newton's and Einstein's ideas, but they cannot contradict Kepler's, because Kepler's laws are just simplified statements of the facts.

There are many places where Rudolf Steiner speaks about this subject. I was stimulated into my investigation of this problem by a statement that he makes in a lecture on the seven seals (*Occult Signs and Symbols*, Lecture IV, 16 September, 1907), in which he is quoted as saying: "It (the sun) advances in a spiral so that the earth, following the sun, moves in a complicated curve." This is not one of Steiner's more detailed statements, but it set me thinking. What would the resultant path be if the sun were moving in a spiral, or, looking at it from above, in a circle, while the earth moved around the sun in an ellipse according to Kepler's law? If the sun moves in a circle of radius nearly the earth's mean distance from the sun, but in an opposite direction, the answer turns out to be a lemniscate. It is a very thin lemniscate, but the crossing point can be made to occur, depending on what radius the sun's circle takes, in the Spring. When one draws the lemniscate upright in the circle of the sun's motion, the gesture is that of the fifth seal, the woman clothed in the sun, standing on the moon with twelve stars around her head.



The only other assumptions that one has to make are that the sun is moving at constant velocity, that its orbital period is one year, and that it starts the period between the centre of its circle and the earth at perihelion. The last condition is not crucial, but produces a more symmetric lemniscate. This model is entirely consistent with Kepler, but it cannot in any way be reconciled with Newton and Einstein, for the only way in their systems for the sun to move around a point of no mass would be for the sun to have no mass. But if the sun has no mass, then gravity cannot explain the planetary motions around the sun. It is entirely possible, though, that the way of thinking about mass introduced by Einstein may yield fruitful results when applied to the possible existence of a negative mass in the sun. But that is not the subject of this paper.

Before proceeding with the details of this solution, I would like to acknowledge the work of Wilhelm Kaiser. It was pointed out to me after my discovery that Wilhelm Kaiser, after personal conversation with Rudolf Steiner, came up with a model in principal very similar to the one I discovered. But in his model the earth does not make a lemniscate. When I describe my model mathematically, I will describe his also.

In what follows I will describe the situation as if the motion of the earth and the sun were in the same plane. In reality there is no guarantee that this is the case, and in fact it is not necessary for this to be the case for the earth to describe a lemniscatory path. I describe this case because it is the simplest to imagine. The model that I find most appealing is when the earth's axis is perpendicular to the plane of the sun's circle. In this case the resulting path is a very complicated motion which crosses the plane of the sun's circle exactly twice, in the Spring and Autumn equinoxes, in the Spring from above and in the Autumn from below. In the Winter the northern hemisphere is turned away from the sun's plane, and in the Summer towards it. In the southern hemisphere the situation is exactly the same but at opposite times. In this case there is no possibility of the earth crossing the sun's plane more than twice as the inclination of the earth's axis rotates, but there are positions where the form of the earth's path is not lemniscatory. If we can assume that the progression of the equinoxes has been constant in the distant past and will be constant in the distant future, then these positions have occurred before the time of Christ and will occur in the time to come.

The equations for the earth's position relative to the sun, taking the sun at the origin and the earth's apsidal line as the x'-axis, are in rectangular coordinates:

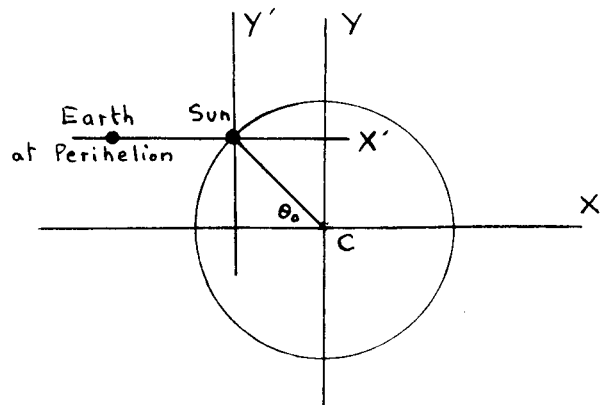
$$x' = a \cos \psi - e ; y' = b \sin \psi ; t = T(\psi - \xi \sin \psi)$$

where $a=1$ is the earth's mean distance from the sun (the major half-axis of the ellipse), $\xi=.01672$ is the eccentricity of the earth's orbit, $b=.99986$ is the minor half-axis of the ellipse, t is the time in days from the perihelion position, and $T=58.13$ days/radian. The angle ψ , in radians is what is called the eccentric anomaly. Its physical significance is complicated, but algebraically it is a convenient parameter. In this case $e=.01672$, but for arbitrary ellipses $e = a\xi$ and is called the linear eccentricity. We assume that the earth and sun are moving in the same plane, and the centre of the sun's circle is the origin of a rectangular coordinate system parallel to the coordinate system centred at the sun. Then the equations of the sun's circle relative to this coordinate system are:

$$x = r \cos(\theta + \theta_0) ; y = r \sin(\theta + \theta_0) ; \theta = \pm(\psi - \xi \sin \psi)$$

where r is the radius of the sun's circle (if we take $r=1.003890$ the crossing point is March 21; if we take $r=.999999994$ it is at the centre of the circle on April 3). The constant θ_0 takes into account that the sun may not be between the earth and its (the centre of the sun's circle which we will call C for future reference) origin at the beginning of its cycle. (See Figure 2.) Then at any given time the position of the earth relative to the sun's coordinate system is given by:

$$\begin{aligned} x &= r \cos(\theta + \theta_0) + a \cos \psi - e \\ y &= r \sin(\theta + \theta_0) + b \sin \psi \\ \theta &= \pm(\psi - \xi \sin \psi) ; t = T|\theta| \end{aligned}$$



To get a lemniscate we assume $\theta = -(\psi - \xi \sin \psi)$, which means that the sun is rotating counter to the earth's rotation about the sun, and that $\theta_0 = 0$, which means that the sun starts its path between the earth and C. With these last conditions the equations become:

$$\begin{aligned} x &= r \cos(\psi - \xi \sin \psi) + a \cos \psi - c \\ y &= -r \sin(\psi - \xi \sin \psi) + b \sin \psi \\ t &= T(\psi - \xi \sin \psi) \end{aligned}$$

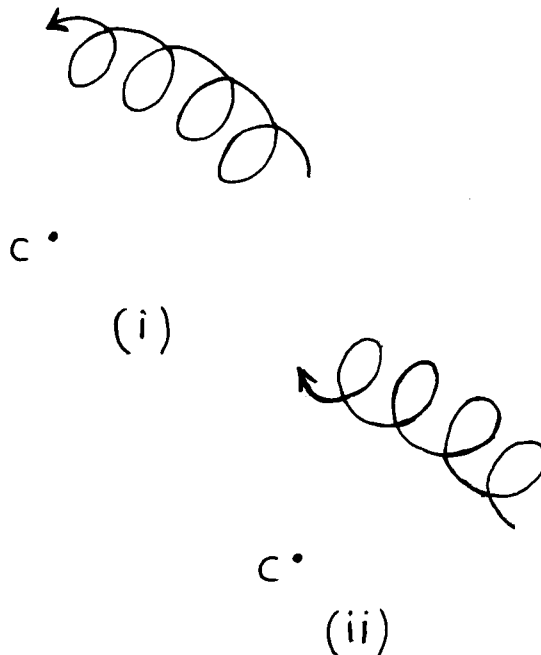
The difference between this solution and Wilhelm Kaiser's is that he starts the motion with the earth and sun opposite C ($\theta_0 = 180^\circ$) and that he has both motions going in the same direction. Equations for his solution would be:

$$\begin{aligned} x &= -r \cos(\psi - \xi \sin \psi) + a \cos \psi - c \\ y &= r \sin(\psi - \xi \sin \psi) + b \sin \psi \end{aligned}$$

In this case the path the earth describes is a small eccentric circling motion very near C. The earth hardly moves at all while the sun moves in its circle around it.

In both cases the planets other than the earth move around C in epicycles. In Kaiser's model the epicycles turn inward (i), while in the new solution the epicycles turn outward (ii).

If either of these models contains the truth, then the ancient view that the planets move in epicycles is vindicated without contradicting Kepler's laws. In both cases the sun's path around C is exactly its symbol ☉. Only in case (ii) does the earth move in a lemniscatory path. In this case perhaps the earth symbol should be changed to ⚝, while the symbol for the reunited earth and sun should be ⚞.



I would like to acknowledge here the help and criticism given by Dr. Georg Unger towards this work. I can honestly say that without his support the development could not have taken place. This work is not finished, and certainly not proved. My hope is that this paper will stimulate others to pursue it further and perhaps create something more definite in this area.

The author is willing to enter into correspondence concerning the above article.

The January 1981 Science Conference

The January 1981 conference of the Science Group of the Anthroposophical Society in Great Britain was held from the 2nd to the 5th of January at Wynstones House, Brookthorpe, near Gloucester. Practical work connected with the main theme of the conference, Steiner's *Warmth Course*, was done in the laboratory of Wynstones School.

In the opening lecture, Alan Hall referred to the evolutionary and historical aspects of heat and to the need for developing modes of observation on the basis of indications given by Rudolf Steiner. At the same time, the normal approach, based on experiment, measurement and calculation, could not be discarded. How do we build a bridge between enhanced observation, in which there is a meditative element, and the more usual practical, logical approach?

Links between the realms of botany and astronomy were discussed by George Corrin and Nick Thomas in their lecture on "Plants and Planets". We were given fascinating glimpses of how planetary influences may be at work in determining the structure, form and aesthetic qualities of plants. This is, evidently, a field full of possibilities for future study. (See also 'Further Notes' below.)

"Is the Spectrum a Reversible Phenomenon?" was the title of Michael Wilson's lecture. The accompanying demonstrations, using black and white patterns in various combinations, projector, prism and lenses, aroused particular interest. Attention was drawn to several aspects of familiar colour-phenomena that normally go unnoticed.

There were, also, nine shorter contributions.

The Senses by Paul Breslau. Can a study of the senses, inspired by the work of Rudolf Steiner and consistent with modern physiological and psychological knowledge, be developed? By what process do we fit concepts to percepts? Series of visual-recognition photographs helped us to observe our own sensory and psychological activity.

Flow Research by John Wilkes. Life on earth is born of movement and of water. But water can become degraded if it is not treated in accordance with its nature. John Wilkes described, with the aid of moving pictures, how flow design research has been applied to create channels and surfaces which produce rhythmic movements in water. This work illustrates how art, science and technology can be blended in the service of man.

Science in State Schools. John Marking described some of the difficulties encountered in attempting to develop a Goethean approach in the teaching of science in a comprehensive school. Curricula which stress the importance of atomic and subatomic concepts tend to lead away from the realm of direct experience, upon which true science teaching should be based.

Heat and Electricity. Hedley Gange compared the realms of heat and electricity—their similarities and contrasts. An extension of the ideas given in the *Warmth Course* can enlarge our understanding of the two borders of matter (upper and lower) which is important in the study of electricity. Reference was made to the heating effect of an electric current (See 'Further Notes' below).

How Does One Use Mathematics? Mathematics evidently plays a fundamental role in Nature. But how should we use mathematics to assist in our understanding and investigation of man and world? Nick Thomas discussed this question with special reference to vortices and path curves.

Colour and Form. Theo Gimbel spoke on colour and form in relation to man's organism and consciousness, including some of the more esoteric aspects. Reference was made to the mutual relationship between colour and form, and to the fundamental role of Polarity in these fields.

Pigments From Plants. The importance of colour in our environment was stressed by

Robert Lord. It is not a matter of indifference what substances we use to produce colour, for purposes of, for example, the interior decoration of buildings. Pigments produced from certain plants may have a harmonising or therapeutic effect.

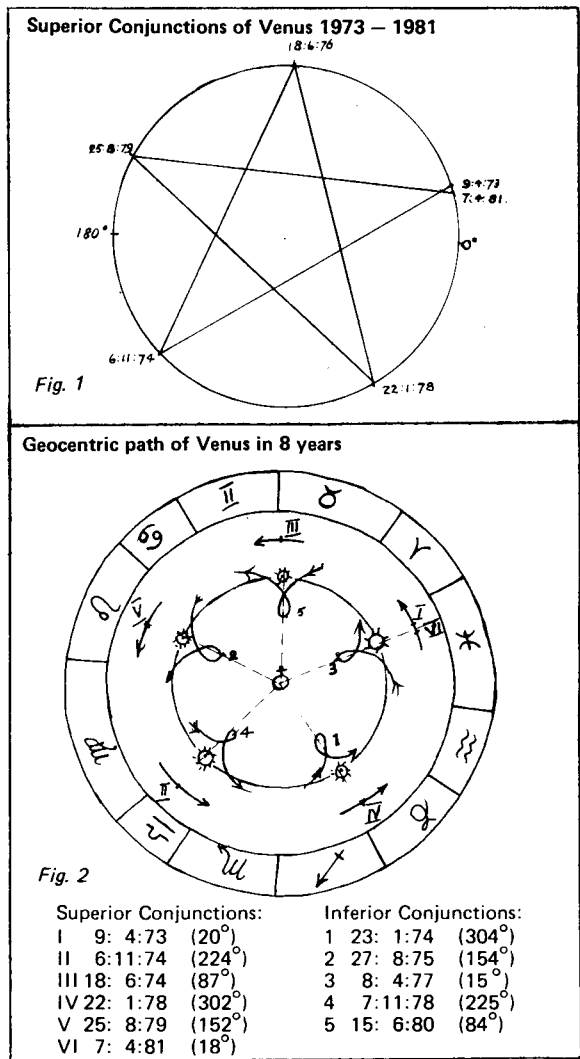
Saturn and the Space Probes by Brian Stockwell. See articles on page 10.

The Dark Spectrum. Joyce Beevor's talk was illustrated with an impressive collection of her own paintings. Four instances where the dark spectrum can be seen were described: in a soap bubble, in an oil film on a puddle, in the sunset sky of Johannesburg and in the lunar halo. (The dark spectrum is the reverse of the normal spectrum. In the latter, green appears between blue and yellow; in the dark spectrum the colours at the two ends of the normal spectrum, red and violet, are brought together—as they approach, magenta appears.) In the soap bubble, colours appear in an ordered sequence, changing as the bubble becomes older and thinner—bands of green and magenta, then peacock blue and golden yellow, finally a velvet black and the bubble bursts. In the oil film, colours also appear in order, although green is not so much in evidence. A brilliant orange or magenta sky may be seen at twilight in the vicinity of Johannesburg. Magenta is seen, also, in the lunar halo. This phenomenon appears, at times, as though one is looking through a cone. Magenta has a great expanding quality and might perhaps be used for therapeutic purposes. However, black is always in the vicinity when magenta arises and care is needed to avoid the production of an impure magenta.

Further Notes

Details of some points arising from the conference are given below.

Phyllotaxis, Colour and Planetary Movements. Botanical observation shows that leaves are arranged along stems, petals in flowers and seeds in seed-heads in a geometrical pattern, referred to by the botanical term phyllotaxis, and not in a haphazard manner. For over a hundred years it has been noted that the parameters involved in these patterns can be expressed as terms in Fibonacci series. That similar patterns can also be discovered in the geocentric, epicyclic paths of the planets raises the question of the possibility of a relationship between the two. This relationship was referred to by Rudolf Steiner.*,**



A 2/5 phyllotaxis can be related to the pentagram made by Venus (as described by Schultz in *Rhythmen der Sterne*, Dornach 1963) and 1/3 with Mercury's approximate triangle. However, it is difficult to make connections that are sufficiently precise to merit scientific status: much work remains to be done!

Steiner also connects the planets Mars, Jupiter and Saturn with the red, the yellow and blue colours of flowers (*Agricultural Course*, lecture 2, p. 35). A preliminary consideration of the chemical composition of plant pigments did not reveal any obvious connections. Rather does it reveal a lack of knowledge on our part of the structure of compounds and the activity of formative forces, the nature and functioning of genes and of protein.

continued on page 12

On Studying Rudolf Steiner's 'Light Course'

A personal account by Michael Wilson

The Problem

When I began to study Goethe's *Theory of Colour* nearly fifty years ago I found certain stumbling-blocks which I could not clear out of the way, and which must have contributed to the fact that the *Farbenlehre* as a whole has not found acceptance with physicists. In studying Rudolf Steiner's many lectures on Colour and in particular those which we know as the *Light Course* I cannot help feeling that Steiner has taken over some of these statements of Goethe as the firm foundation for further explanations. For those of us who feel that it should be possible to follow these explanations with the logic on which our scientific education has been based, some of these assertions appear as hypotheses which have yet to be tested, whereas Steiner presents them as self-evident truths. One of these is Goethe's so-called 'Urphenomenon' which states that light seen through darkness appears yellow or red while darkness seen through light appears blue or violet. While this is mostly true where some form of scattering medium is interposed between us and what we are looking at, it does not satisfy us as a description of those phenomena where the colours appear side-by-side rather than seen through one another. (There is also the condition where the texture of the 'turbidity' is coarser than the texture of the light, in which case the appearance of the colours is reversed. But this brings in a factor which requires a separate chapter of study.) As a description of the appearance of the colours of the spectrum it is by no means a self-evident truth. When the light-dark pattern which the prism converts into coloured bands is made to rotate with respect to the prism (whether this is done by projection or by viewing the pattern through the prism) the coloured pattern immediately takes on a three-dimensional appearance. But although we instinctively see the pattern as having a definite 'depth dimension' we cannot say whether the blue or the red colours are 'in front of' or 'behind' the surrounding darkness. We can equally well visualise it either way. I find that I therefore cannot accept the statement in Lecture 4 that 'a clear proof that you have here a darkening (*ein Abgedunkeltes*) is the fact that the blue colour arises'. I cannot find a

one-to-one relationship between the spatial orientation and the appearance of red or blue.

This does not mean that I reject Goethe's 'Urphenomenon' as a false hypothesis, but it does mean that I must search for the truth of it at a far greater depth than the simple experiments that are dealt with in these lectures. I find comfort in Rudolf Steiner's opening remarks that he expects his audience to be fully acquainted with the contents of his spiritual science and that he does not expect to be understood by the conventional physicist.

The Cosmic Background

We must think back to Rudolf Steiner's descriptions of the cycles of evolution of our planet. The 'active darkness' first showed itself after the separation of the moon-earth from the sun-body. Before this, the darkness was not separated from the light, and only after this separation did the new dimension of colour begin to develop. Thus we learn to think of the experience of light developing out of the primeval element of warmth (sun-evolution), and the experience of colour developing out of the tension between the forces of darkness and the forces of light (moon-evolution).

The patterns which arise out of the interplay between darkness and light are determined by the formative forces which we call the chemical ether. The numerical proportions which constitute our science of chemistry are an expression of this chemical ether. Whereas the visible *forms* of our surroundings are expressions of the light ether, the hidden *proportions* of their structure are expressions of the chemical ether. Thus our visible world arises out of the warmth of the past and develops towards the darkness of the earthly forces in which the chemical ether separates itself. (The 'life ether' is a more difficult chapter.) Where the light is 'stretched out' by the tension between darkness and light, we find that the red colours remind us of the past and are an expression of the forces of warmth whereas the blue and violet colours draw us into the future where we begin to use the chemical forces of those radiations which are 'beyond the violet'. We already speak of 'cold light' as distinct from warm light. The warm light is still associated with fire, but the

cold light is mostly associated with electricity.

The appearance of rhythms

We find in our surroundings that rhythms arise out of the confrontation of dynamic and static forces, and this seems to be true at all levels. Rudolf Steiner lays this principle at the foundations of much of his teaching. In one of his last letters to the members he stressed that fact that all rhythm is half-spiritual and half-physical, and that what we need to do is to find and recognise the spiritual forces which are trying to express themselves through the rhythms.

Whatever theories we may form about the nature of light as we know it, our whole world of light and colour shows rhythmic forms arising when light is confronted by matter. The ordering of the colours in the rainbow is itself an expression of a rhythm and when it is very bright it shows subsidiary fringes which are smaller repetitions of the main rhythm. A soap bubble or a spot of oil floating on water shows similar rhythms, and if a soap film is held so that it forms a vertical plane, it soon drains downwards and shows a characteristic series of rhythmic bands of colour. The theory that all physical appearance of light and colour has a rhythmic basis arises out of observations such as the above, and this has led to a basis of measurement and calculation which we know as the wave-theory. All our modern optical technology is based on the consistency of this theory, and at present we have no other method for dealing with the phenomena that present themselves.

I have found it a simple matter to repeat Thomas Young's experiment, measuring the wavelength of red light using crude home-made apparatus, and a very simple geometrical formula. The measurements are only very approximate, but one makes intimate acquaintance with the thought-processes involved.

The sensation of colour

Since Young's experiment we have built up accurate and rapid methods of colour measurement, but we have also found out that our sense-experience of light and colour is not wholly dependent on physical radiation. The coloured after-images which the eye produces, and the colours which appear in the 'coloured shadows' are not directly measurable in terms of wavelength and seem to be partly independent of physical laws. I think that these colours must be more related to the spiritual side of the rhythms and less to the physical side. One of the mottoes of a modern colour-laboratory is 'Colour is a sensation and therefore cannot be

measured'.

The wave-theory in cosmic perspective

If we look at our science of light and colour that has arisen from the work of Newton, Huyghens, Fresnel and others we must conclude that what we are measuring is the physical half of the world of vibrations, and that this tells us little or nothing about the real nature of the spiritual half. Looking at this world of vibrations against the background of world-evolution, we see that the cosmic process of condensing, rigidifying and darkening is associated with an increase in the speed of the rhythms, that is, greater frequency and shorter wavelength. Putting our knowledge of the spectrum into this perspective, we can begin to feel that the violet *colour* which has the shorter waves as its physical 'carrier', is itself an expression of those earthly forces that lead us into the future, while the red colours which have longer wavelengths as their physical carrier are memories of the warmth and fire out of which our present world has evolved. We can begin to feel that the measurable vibrations are the earth's *answer* to the cosmic forces of light, darkness and colour, rather than the *origins* out of which the sensations of light and colour have developed.

Our present situation

We feel the red shining toward us out of the light and wisdom of the past into our present spiritual darkness, while the deep violet draws us forward into the future where the darkness begins to be illuminated by the light of our own understanding. But we have achieved so much freedom in the way we can manipulate light in our laboratories that many of the phenomena we produce are but the reflections of our own earthly activity rather than the expression of cosmic laws. We can, for instance, make red or blue or any other colour appear either as a lightening of the darkness or a darkening of the light.

To understand the Goethe Urphenomenon at the cosmic level gives us a perspective, a vista of the direction in which we can develop some of the experimental work which Rudolf Steiner expected of those scientists who were listening to him when he gave the lectures of the *Light Course*.

In these pages I have elaborated only *one* thought. But the cosmic background that Rudolf Steiner has given us also throws light on questions such as the nature of the coloured shadows, the line spectrum, the phenomenon of interference and other matters which are mentioned in the lectures.

Saturn and the Space Probes

Brian Stockwell and Hedley Gange

In a Short Contribution at the January 1981 Science Conference, Brian Stockwell asked whether the results of recent scientific investigation of the solar system, using space probes, necessitated any re-assessment of the descriptions of the nature of the planets given by Rudolf Steiner. He referred, particularly, to the close studies of Saturn made by the two American spacecraft, Pioneer II and Voyager I.

On several occasions Steiner described conditions as they existed on Old Saturn in the remote past, but he also made some references to the nature of the planet Saturn as it now exists. He said it was an optical illusion that we see Saturn as a slightly bluish gaseous globe—the present Saturn still consisted only of heat substance. The illusion arose because we see a dark object through a light-filled space*. This did not agree with scientific descriptions of the day, which regarded the planet as less dense than Earth but certainly more substantial than heat. This difference between the anthroposophical and orthodox views could be attributed to the limitations inherent in the modern scientific method, and the practice of extrapolating earthly conditions into cosmic space, to which Steiner referred on other occasions.

Can this explanation be maintained in view of the information sent back by Pioneer and Voyager?

Voyager I carries an array of cameras—miniaturised television systems linked to telescopes—giving high resolution narrow and wide angle views. It also has sensors for measuring temperature, the composition of atmospheres, cosmic rays, magnetic fields, atomic particles, radio emissions, ultra-violet and infra-red radiation and solar wind. The interpretation and assessment of the information provided by the spacecraft is still proceeding, but preliminary reports have been published. These certainly included some findings which startled the NASA scientists. The outlying F ring appeared to be 'braided'. The small number of rings visible through modern telescopes and identified by Pioneer II became

hundreds of separate rings. 'Spokes' appeared in the B ring. These phenomena were at first sight described as apparently inexplicable in terms of conventional physics.

So there is still room for doubt and argument about the interpretation of the data, and the theories and assumptions involved. But there is strong evidence, supported by the earlier Pioneer II findings, that the present condition of the planet is rather more substantial than that of a body of heat, i.e., that it is a gas ball composed largely of hydrogen and helium with a solid inner core and an outer core of ammonia, methane and water. These were hypotheses based on measurements of gravitational field and temperature profile, and more detail must be awaited. But if all this is so, why did Rudolf Steiner give an apparently incorrect description? Or is it possible that his knowledge of the present state of the planet, derived from spiritual perception, was incorrect?

Brian Stockwell's talk was followed by a short discussion. It was generally felt that the questions he had raised were timely and there was a need to keep abreast of current scientific research in the field of space exploration. Any discrepancies revealed between the results of this work and currently held anthroposophical views should be investigated. Reference was made, during the discussion, to the fact that some anthroposophists had held the view, in the early 1950's, that space vehicles constructed and equipped in accordance with earthly science would be unlikely to be able to function satisfactorily in the vicinity of distant planets, owing to the different forces and influences at work in these regions. (See notes entitled "How to gain true ideas of the Star World" in General Anthroposophical Society, English Section, News Sheet No. 42, Sept. 1957). Some still find it remarkable that complex electronic and other equipment can work with great precision in parts of the solar system remote from the earth.

In the following article Brian Stockwell looks at some of the recent reports of the Voyager I

and Voyager 2 (August 1981) missions in the light of Steiner's statements.

* Steiner, R. *The Spiritual Hierarchies*, Lecture 8

Saturn—The Voyager Missions

Brian Stockwell

The mass of information sent back by the two Voyager missions (November 1980 and August 1981) may take years to process fully. Available so far (to September 1981) are a preliminary analysis of the Voyager 1 results, and only initial reports from Voyager 2. NASA scientists were startled by some of the discoveries, which at first sight are inexplicable in terms of known physical laws. The physicists' search is on for theoretical models which will explain the phenomena. But at this stage it looks as if explanations deriving from the descriptions of Saturn by Steiner and Wachsmuth (referred to at the Science Group's January Conference) are not incompatible with some of the new data.

In this brief article there is room only for some highlights. To deal first with the rings: Voyager 1 discovered hundreds where Pioneer II (December 1979) had identified only a handful; Voyager 2 found thousands of separate ringlets within the main rings. It was theorised at first that the 'braided' F ring seen by Voyager 1, and some other complex and eccentric ring structures which appeared to violate the known laws of orbital mechanics, were caused by the gravitational pull of small 'shepherding' satellites. Two candidates for this role were found by Voyager 1, and Voyager 2 was re-programmed to search for others; but it did not find any. Brad Smith, head of the imaging team, was quoted by *New Scientist** as saying: "We're now at the point where we had hoped not to be and are looking desperately at other solutions."

Composition of the particles composing the rings is not yet clear, though it is established that they are solid. Changes in the radio signals as Voyager 1 passed behind the rings showed variation in particle size apparently decreasing from the outer to the inner rings.

All this is consistent with Wachsmuth's statement that the Earth's etheric structure is precisely reversed for Saturn, the life ether associated on Earth with the solid state of aggregation lying outermost and the warmth ether at the centre.** A further reference by Steiner is relevant to the solid material. He ascribes a cometary origin to the rings, comets being of a mineral nature.***

None of the space probes has penetrated to the surface of Saturn, but there are some indications from Voyager 2 that the previous assumptions of solid and liquid cores (admittedly hypotheses from measurements of gravitational field and temperature profile) are unproven. Saturn's magnetic field is apparently tilted only one degree from the axis of rotation—a much smaller tilt than for any other planet. The current theory explaining planetary magnetic fields is that they are generated by electric currents within a liquid core—but this would require that the field does *not* line up with the axis of rotation, as Saturn's does.

Other new data are relevant to Steiner's view that Saturn is still essentially a warmth body. As regards gravitation, the small moon Hyperion which is described as 'peanut shaped' has sprung a surprise. Its long axis points out of

the plane of orbit, not towards Saturn as the normal pattern of planetary gravitation would imply. The density of Saturn is now calculated to be 0.7 that of water so that, as *New Scientist* put it, "it would float if you could find an ocean big enough to put it in". There is as yet no confirmed theory to explain the mysterious 'spokes' in the B ring which appear to defy 'normal' gravitation.

The surprisingly high level of heat radiation, measured by Pioneer II as 2.5 times the heat received from the sun, was attributed to a slow gravitational separation of helium and hydrogen at liquid temperatures in the outer regions, with the heavier helium and hydrogen sinking towards the centre. This theory received some confirmation from Voyager 1's information that the planet contained a higher ratio of hydrogen to helium than Jupiter. The level of heat radiation itself is consistent with Wachsmuth's analysis, although a gravitational mechanism of the kind suggested would probably not be. One can speculate that, just as with the Earth's etheric structure, there is a rhythm of movement between the inner and outer etheric forces; and that the gaseous atmosphere seen by Voyager 2's cameras and measured for temperature by infra-red scanning are what would be expected as the formative forces rarefy towards a warmth ether centre.

It is perhaps also worth noting that the Pioneer II probe reported colours for Saturn

described as 'more pastel' than those of Jupiter and its appearance as 'more bland'.

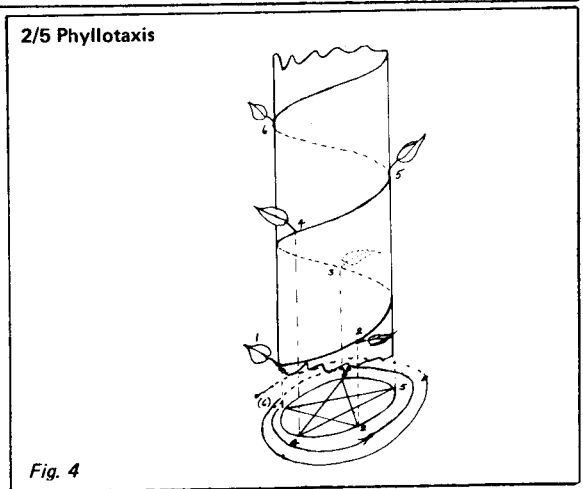
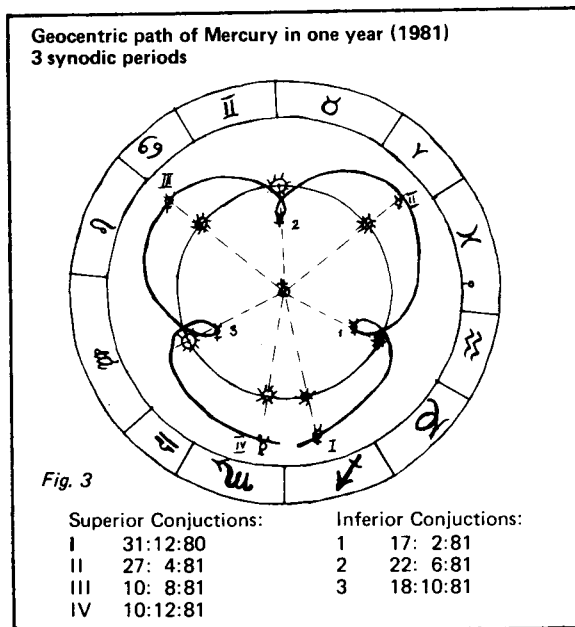
I think it is fair to add two general points. Without conceding anything to the extreme view that the Voyager instruments may present illusory information, it is a fact that the information can relate only a part of the physical reality. To that extent, the questions asked determine the kind of answers given. A similarly limited picture of the Earth through Voyager's instruments would miss a great part of the reality! The second point is that, as NASA scientists have conscientiously warned, the pictures seen on TV screens are approximations. Television's scanning pattern can accommodate only a quarter of the information sent back. Furthermore, in some pictures, colours, for example, may be enhanced or false-colour coding used to assist scientific analysis.

At this early stage it would be unwise to go beyond the speculation that, at least, the issue is still open. A fascinating inquiry is in prospect for us when the whole mass of data has been processed.

References:

- * *New Scientist*, 27 August 1981
- ** Wachsmuth, G. *Etheric Formative Forces in Cosmos, Earth and Man*
- *** Steiner, R. *Spiritual Beings in the Heavenly Bodies and in the Kingdoms of Nature*, p. 199

continued from page 7



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- * Steiner, R., *Spiritual Beings in the Heavenly Bodies and in the Kingdoms of Nature*, Helsingfors 1912, chapter 9
 - ** Steiner, R., *Köln*, 6/5/1912.

Nick Thomas
George Corrin

News & Comment

THE FLOW RESEARCH GROUP, EMERSON COLLEGE

Flow design research was begun in 1970 and led to the formation of this group in 1975. The principal aim continues to be an investigation of rhythms and their effects upon the life supporting capacity of water. Rhythmical processes are induced in streaming water by means of vessel proportions related to gradient and flow-rate. This is achieved through an empirical approach to the relationships between static form and fluid movement. The design process is described as a method which has been patented. The resultant, so called, 'Flowform' vessels utilise the circling motion of water creating a lemniscatory flow path. This could also be defined as a vortical meander. Recent investigations indicate that this method although developed and applied artistically in a wide variety of situations may well be definable mathematically. The rhythmical metamorphic potential hidden within fluid processes in nature is clearly demonstrated by Theodor Schwenk in the *Wirbelstrasse*. These metamorphic processes are manifest as a fundamental aspect of the organic world. The task is to create 'organs of metamorphosis' which will enable water to reveal its movement potential and thus be brought nearer to living processes.

Water today is often so intensively used and thus polluted, that it does not readily re-enter the natural cycle harmoniously. So there are tasks relating to purification and regeneration, recycling of water, irrigation, farming preparations, animal husbandry and domestic use; the treatment of food substances, medicines and therapy.

For the purpose of investigating these areas a number of installations have been or are being built. In Holland, at Warmonderhof, a major installation has been in use for the last year. Also, in Germany, Norway, Sweden and Switzerland further research facilities are in use. At Emerson College the hope is to continue with building the Institute which will facilitate

design and scientific research. Almost two years ago we were able to welcome collaboration with Nick Thomas. At present he has very limited space in which to develop the Drop Picture Method, harmonic analysis, germination and quality tests, and further investigation on Flowform fluid dynamics.

Results we shall be publishing as soon as available.

John Wilkes

A SCIENCE GROUP IN AUSTRALIA

Hendrik Dierich has given us the good news that a science group has been formed in Australia at their Christmas 1981 Anthroposophical conference. Their aims are to exchange information and ideas with a view to organizing seminars and conferences and possibly a magazine too. All our good wishes to them in their venture! The address of the group is: Hendrik Dierich, 54 Stafford Street, Paddington, Queensland, Australia 4046.

LIGHT UNDERGROUND

In one of the latest developments in telecommunications, light is channelled into thin glass fibres, numbers of which are formed into a cable, which is then buried under the ground. These optical fibres serve as 'carriers' for large numbers of telephone conversations. Some telephone calls on the public network in Britain will shortly be routed via these 'light circuits'.

This is a logical outcome of the world-wide demand for more and more channels of communication: radio, video, data, military, etc. As the radio-communication spectrum became increasingly congested, the possibility of radiating light energy instead was investigated. This proved unattractive, however, owing to the severely adverse effect on signals of fog, rain and snow.

Attempts were made to transmit light beams along tubes, so securing protection from atmospheric disturbances. Lenses were inserted in these 'light waveguides' to counteract the

tendency of the light to spread, and curved mirrors were fitted to allow the light to travel around bends. This system, too, was abandoned, since practical difficulties rendered it uneconomic.

In 1966 the possibility of using flexible glass fibres was suggested, although at the time the high level of attenuation of the signal as it travelled along the fibre was an obstacle. About 1970, it became clear that fibres with lower attenuation characteristics, around 20 decibels/km, could be produced. Since then, progress in the development of complete systems has been rapid. Signalling rates in excess of 100 megabits/sec can be used. (The provision of a transatlantic optical fibre cable is currently under consideration.)

This is a considerable technological achievement, the reward of persistence, ingenuity and skill, but, to the sensitive or artistically-inclined, it may raise the question, applicable to technology generally, "What are we actually doing to the Spirit of Nature when, for example, light, instead of radiating freely, is severely restricted and buried underground?". Various aspects of Nature are traditionally associated with elemental beings: Undines with water and Sylphs with light and air. In many technological processes and devices, the Nature-spirits associated with warmth, sound, light and organic activity are being harshly treated and constrained to lead an 'unnatural' existence.

This is, no doubt, a necessary stage in the evolution of man and Nature. But, if the current trend towards 'technology autonomous' is to be checked, a wider outlook is needed both within and outside the sphere of technological activity. An appreciation of the fate of the elemental beings, in modern civilization, can be an important factor in the creation of this wider and more 'human' attitude.

Reference:

Lilly, C.J.: *Making Light Work*, IEE Journal, September 1981

Hedley Gange

THE MARGARET WILKINSON RESEARCH FUND

In the Spring of 1981, four members of the Science Group Committee took over the trusteeship of the Margaret Wilkinson Fund. This Fund is, under the terms of the late Margaret Wilkinson's will, "for organisations doing research based on Rudolf Steiner's information by members of the (Anthroposophical) Society". The term 'research' is not, of course, limited to the sphere of

science, although most of the grants made by the Fund have indeed been for scientific work.

To be eligible for a grant an applicant must, then, be (a) sponsored by an organisation based on Rudolf Steiner's impulse, and (b) a member of the Anthroposophical Society, as well as being able to satisfy the trustees as to the merit of the proposed research. Further information and applications should be addressed to the Secretary of the Science Group, Rudolf Steiner House, 35 Park Road, London NW1 6XT.

In 1981 two grants were made, and a third is pending (totalling about £3,000). An outline of the two projects follows:

Lawrence Edwards writes:

- 1) I will be continuing research into the nature of flower and leaf-buds, considered as bearers of life-force. Is it a fact that the capacity to take up, or be permeated by, life-force is really affected by small and subtle changes in the *form* of the bud? This involves the photography and analysis of many hundreds of buds each year; and as the work proceeds, evidence for the fact that the projective geometrical *form* of the bud is a potent factor is gradually accumulating.
- 2) Research into the various transformations in the form of the left ventricle of the human heart in the course of its beating, work which involves measuring and analysing between forty and fifty pictures for each single heart-beat.
- 3) Work on the transformations of form undergone by flower-buds in the course of their opening.
- 4) It is hoped to start new work on embryological form in due course.

Nick Thomas writes:

My research project is a co-ordinated investigation of the possibility of describing etheric forces in precise terms, to be followed under three specific headings:

- 1) The further development and application of projective geometry to formative phenomena, embracing directions started by George Adams, Olive Whicher and Lawrence Edwards.
- 2) The scientific investigation of rhythmic phenomena associated with the Flowform invented by John Wilkes, forming part of the work of the Virbela Flow Research Programme. (See report on the Flow Research Group.)
- 3) The investigation of potentiation phenomena to support the proving of efficacy of medicines.

Howard Smith

Transubstantiation in an Atomic Age

Hans Heitler

Adapted from a lecture given to an ecumenical gathering
on Iona, June 1965.

PART TWO

In the first part of this lecture, published in Science Forum No. 2, Hans Heitler showed how different technological discoveries (e.g. heat engines, electricity and nuclear power) derive from regions of man's own nature by a process of externalisation.

The question which we posed earlier, namely how it was possible that in the last hundred and fifty years evolution should have taken such a decisive turn that a completely new creativity came into existence demands an answer. Nothing whatsoever in the past can be compared with it. All that has been put into the world in previous ages, be it the pyramids in Egypt, the Greek Parthenon, St. Peter's in Rome, all unequalled in modern times, cannot be compared with what now covers the earth in the form of machinery. These earlier achievements represent the relationship of man with the Divine and the Cosmos. In our machines nothing of this is contained except what is present if we only care to see it: all the forces of the earth and nature are moulded and arranged in such a way that in an altogether grotesque manner man himself appears. Man's physical existence has been formed out of the dust of the earth and into this the Divine poured its essence. Look at the wonderful picture by Michelangelo. Adam lying on the barren ground, being almost one with it, but stretching out an arm as far as he can and as his being bound to the Earth allows. And from above out of the clouds leans the Father-god, held back by angel figures, as if he was in danger of falling out altogether, his finger almost touching Adam's. One can almost see the divine spark entering him. From that moment onward Man was created, and all the earth substances within him, enlivened by the divine spark, are raised to a higher level. They are so transformed that the human soul and the living spirit can find a habitat. We can analyse chemically our body and find oxygen, nitrogen, calcium, phosphorus, etc., chemically indistinguishable from what we find elsewhere. But all the same, every cell, every molecule within us is decisively different because that is essential for the incarnation of our soul and spirit being. A chemistry of the future will probably be able to show this even in a scientific manner if we have scientists for whom this is a burning question. If we imagined

that this 'begodding' as depicted by Michelangelo had not taken place, man would have remained an earth creature, completely given over to the earth-nature processes and forces. And if, with a thinking power comparable to our own, we then abstracted certain features, we would come to the machinery we have now.

However, these are speculations. We are confronted with the fact that quite recently man has developed the powers to externalise this lower nature of his. Why was there no sign of it before? Let us try and look at the evolution of man now in a somewhat different and probably unusual manner.

Descent from Paradise

There are two events which, so to speak, form the cornerstones in the history of man. The first one is his fall from Paradise, and the second one is the incarnation, death and resurrection of Christ. Let us look at the first one.

It does not matter in what way we interpret the story as given in Genesis, either believing that Adam and Eve were a man and a woman in the literal sense, or looking upon it as symbolic. They were in the Garden of Eden in the state of innocence and were allowed to eat of every fruit except that of the tree of knowledge of good and evil, because "in the day thou eatest thereof thou shalt surely die". How strange this really is. Have we not considered now and all through historical times the knowledge of good and evil as a high virtue and not at all as a sin? And why is it that the eating of the fruit from this tree brings about the downfall into the archetype of sin, which as original sin we carry to this very day? We stand here before a deep mystery and when we take the words of the Bible seriously and not trivially, then we can feel that they touch the secret of the relation of knowledge and morality which we have already put before our minds. There is man in the state of innocence. He is in perfect

harmony with the heavens and earth. Good and evil have no meaning for him.

He eats the forbidden fruit and this has clearly a decisive effect. An element is introduced into his being—we would call it today metabolism—which in one sense enhances the bodily organisation, and in another degrades it. Enhancement in so far as man was put on the path towards becoming what he is now with his new powers of discernment. In a certain sense, his existence as man centres around the discernment of good and evil. On the other hand with this new power of discernment he has to give up his innocence. His growing powers of thinking cannot be acquired unless his presence before God is diminished. Union with God as in the Garden of Eden and power of thinking which is man's own spirituality, are incompatible and the separation of Creator and Created is inevitable. They have to part. Man is sent out into the wilderness, and through pain and sorrow and by the sweat of his brow he has to proceed towards his own fulfillment.

We follow the path of the ancient Hebrew people, which was destined to be of such central importance later on. We see a closely knit community under the guidance of God, or rather of such outstanding personalities as Moses and the prophets. Moses had to bring the laws as commandments from God. This was the form through which contact with God would be preserved. And ever so often had the prophets to rave and thunder against the departing from what was the right path. Without these intermediaries the mass of the people would have gone hopelessly astray.

The Chosen People moved more and more away from the paradisaical state into the darkness, void of the Divine Light but gradually filled with the awareness of the growing powers of the individuality. Then the events occurred in Palestine in the midst of the Hebrew people of which one can get the impression that it had grown tired and exhausted yet was still hanging on to and looking back to its unique history from Abraham. And soon afterwards the Temple in Jerusalem which was the focal point, was destroyed and what was left of the people dispersed all over the world.

What would have happened, we may ask again as a purely hypothetical question, if Christ had not incarnated nearly two thousand years ago? The forces of individualism would have grown and with it egotism. Abstract and rigid thinking would have dominated and within the soul of man the dim feeling of his divine origin many generations before would eventually have disappeared altogether. There may have lived for a time the expectation of the Messiah but it would also have lost its reality.

But the event did occur and for three years Christ performed his ministry, taught and trained his disciples so that later on they could become apostles. And the night before he was destroyed, at the Last Supper, he blessed the bread, broke it, and said: "Take, eat, this is my Body which is given for you." And about the wine after the supper, "Drink ye all of it, this is my Blood which is shed for you."

The Last Supper

We stand here at the most central point in Christianity. We are all aware what arguments, dissension and strife was caused in the endeavour to understand and interpret this event and how far we are still away from an understanding which is generally acceptable, and it may seem to be presumptuous to talk about it at all without raising again all the old quarrels. Let us try therefore to look at it with the least presuppositions and an open mind. There is one point about which we can all agree, and that is that in the person of Jesus Christ, as he was then in a human body with all that is entailed in it, we recognise the incarnation of the Divine. There walked on earth a being, human in all respects, except that his spirituality was not a human individuality, however high it may have been, but, as it is termed in the Scriptures, the Son of God, a principle far and away higher than any human being can ever hope to be. Whereas any human being can be seen as a product of evolution from lower forms upwards, not only in the Darwinian sense but also spiritually, we have to see in the Incarnation a descent from infinitely higher regions. If we remember again Michelangelo's picture and imagine how the artist would have depicted the Incarnation, he may have shown how the Divine being let go of the last tenuous hold of the Heavens and entered right into the body of Man, thus bringing all His power with Him.

And now right at the end of his earthly sojourn he is together with the twelve disciples and performs this momentous deed, accompanying it with mysterious words. He takes the bread: fruit of the earth, but not as the earth has produced it. It had to be cultivated, harvested, ground, mixed with yeast and baked. The original corn has been so transformed by the labour of man that it is almost impossible to recognise it as it grew in the field. We may remember how Cain, the tiller of the earth, offered God the fruit of his labour, and God rejected it. Is it that this otherwise unintelligible rejection in fact meant that God said: Keep it and take it into your own care for the future, because if I accept it you will never be free of me? And is it perhaps this bread which through the care of man has

matured so much that now it can receive the Divine blessing? In other words, is it imbued with such divine power that when eaten it will transform the human body in such a way that it is preparing it as an instrument for a higher spirituality?

We have to weigh each single word for its deeper significance and we can be quite sure that we can only make a beginning. "Take, eat," Christ said. He did not say, "I give you," but "take". He asked the disciples to stretch out the hand, put the morsel into the mouth, chew and swallow it. An active deed is demanded from them, and these men who had seen so many signs and miracles must have been aware of being partakers perhaps in an act of the greatest significance. It was through their own action that they incorporated into their bodies bread which had received something of the exalted powers of Christ. They ate it and with this it disappeared from their conscious awareness. It was taken up into those dark regions of metabolism. It then permeated their bodily organisation with a higher power. Whereas the ordinary food is lifted up to substances which can carry the soul and spirit of man, now this bread implants a seed into the body which will lift it up to a more perfect organ to be used by higher spiritual forces. We can say therefore that the offering of Cain, returned to him so that man can work on it and prepare it for a future task, has now been taken up by Christ, endowed with his own forces, and returned to man so that it can work within the physical organisation for future evolution. A new fire in the metabolism of man has been kindled.

A New Impulse

Do we find any signs in the later events which could indicate how this fire took effect? Indeed I believe that this is so. Hours after the last supper we witness the betrayal of Judas, the denial of Peter, and in general this handful of disciples in fear and trembling that their name might be connected with that of their master. He fulfils his destiny and goes through death. And the third day He rises from the dead and the disciples were witness to this. Yet still, they assemble in the Upper Room behind closed doors because they are afraid. All the teaching and example of Christ during their discipleship has not given them strength and courage to bear witness openly. How far they still are from living up to the example they have had for so long before them! Christ comes to them, though not any longer in the body in which he was crucified but yet in a form in which they can see the wounds. Can we not take this as an indication of the immense importance of the

physical body as distinct from the material one? Is it not as if Christ wants to show them that the division into body and spirit is no longer valid, that in fact through his incarnation he achieved the spiritualisation of the body? There it is for them to see as a reminder and stimulus that they also should realise the importance of the body.

It goes further. There follows the story of Thomas who would not believe until he had touched the wounds. What was it he would not believe? That there should be a body enduring after death. He knew that the human body in its imperfection dissolves after death and not only the materiality. The spiritual archetype of the body has so far found only very incomplete realisation within any human beings. It stands there in the heights of heaven as the image of the Elohim who had formed it; so far not one human being has a body of such a spiritual form that it could endure in the face of the archetype. And now Thomas is told that it has been achieved. No wonder that, overwhelmed by the immensity of the story if true, he wants to see for himself. When a week later his wish is granted and he touches the wounds in the hands and thrusts his hand into His side, he speaks these simple words: "My Lord, my God". It was an experience of the most magnificent majesty, expressed with the humility which only the very greatest in a moment of sublimest revelation can have. There stands Christ before him with the body which he has carried through death. The long and dreary journey since Adam into ever greater darkness has come to an end and the body which has so far been a tool to shut the spirit off from the spirit, this 'sinful' body, is confronted with a new picture—a picture which shows what in ages to come will be the goal of an upward evolution once more.

And then comes the day of Pentecost. "They were all with one accord in one place". There is no mention of closed doors or fear any more. A new purposefulness and strength permeates them. A new fire ensouls them. Is it not the Christ-imbued Bread which now begins to take effect in them? Is it not this that enhances their bodies to such an extent that the new spiritual powers can find expression, that they are able to speak in other tongues as the Spirit gave them utterance. Yes, the Holy Spirit found at long last in these twelve such bodies as enabled Him to give utterance, bodies on the way towards that archetype which stood before the disciples, and Thomas in particular.

The last deed of Christ on Earth was the blessing of the bread and wine. He handed over in this form his own power which had already ennobled his own body to such a degree that he could take it through death. And right up to his

ascension he pointed to the importance of the forces connected with the physical body. "Have you any meat?" he asked before the miraculous draft in the sea of Tiberias. And then the first fruit of this great deed of the Last Supper became apparent at Pentecost.

The New Creativity

We cannot go into any detail of the evolution of mankind which followed. Fourteen hundred years later we can notice a turning point when mankind became interested in the outer world to a much higher degree than ever before. What was beyond the Pillars of Hercules? Is there another way to reach India if the world is really round? What is the real relationship between sun and planets? What does a plant look like when seen through a microscope, and so on? Man's horizon widened out enormously because he felt the urge for it to do so, in contrast to earlier ages.

And another three hundred and fifty years or so later another outburst occurred, a great part of which is still in living memory: the technicalisation of the world. What happened that mankind was suddenly able to adopt such a change of attitude; why had he suddenly an urge to extend the use of his senses, to look at nature with his intellect in a critical manner, again something which did not occur before? Of course, all this was only possible through a decisive step forward in intellectual faculty, but this could not occur without a corresponding development of the bodily organisation. As man is organised today, intellectual-mental faculties are intimately linked with the physical organisation. It would be quite wrong to say that his thinking is produced by the brain, but it is nonetheless true that without the brain as physical basis this thing could not appear in our consciousness. We may compare it with a mirror and the manner whereby we can see. Light as such is invisible. We do not perceive its passage from the source to the wall. Only when it impinges upon a material substance does it become visible. Yet nobody would deny the existence of light independent of the wall. In order to give a true image of the emitter of the light, it would have to have a mirror surface. It is similar to the relation of spirit and body. The higher the spirituality, the higher the organisation of the body. These two have to be in correspondence.

And now we have the fact that with the production of machinery, as we have seen, something like the human being has been put into the world. We look at the machines and far below the level of the human being his own image appears. A new power of creativity has come into existence, new will has taken

possession of man. Would this have been possible if Christ had not shared his power in the form of the transubstantiated bread and wine? If that was not of the utmost importance it would not be comprehensible why it assumed such significance in the ensuing centuries. True, with the Reformation it retreated somehow into the background in the Protestant Churches but in recent decades it has come to the fore again and in the movement for unity of the Christian Churches the paramount problem seems to be: how can Holy Communion become the rallying point for the union in Christ? However this may be, I cannot consider it as chance that these two great events, the technicalisation of the world and the longing for union in Christ, coincide. Has it not already come about that through science and technology in connection with economics, mankind has well advanced towards becoming one organic body? We are more and more aware that any actions in these fields have worldwide repercussions. We can read in the papers every day that an action of a handful of people has effects on thousands of others quite out of proportion to the primary cause. We cannot any longer consider ourselves, even in groups, independent of the immensely complex structure we have built up in the industrial-economic field, and we cannot therefore escape responsibility for it.

Have we therefore to submit to it and feel helplessly weak in the face of it? Certainly not. We have created it and it turns out to be our own image, but only insofar as our own inadequate and abstract thinking has been able to realise it. It is by necessity a ghost, a structure as if alive. But ghosts have powers nonetheless and these have to be reckoned with. Just because we have brought up something from the depths of our own and the Earth's existence, we have touched on the highest powers in creation. One of the sayings of deepest wisdom has come over from ancient times: "As above, so below." When we take something belonging to the heights without recognising and acknowledging it, we open the door for counterforces. In other words, if we use forces essentially of a spiritual quality yet deny them, they turn into their opposite and instead of enhancing our freedom, they enslave us. The cry of Creation is really: "Open up our secrets, they are all yours if you can only see us in the husks and shells. But if you refuse us, if you take only what you in your egotism believe is our essence, then you free those forces which correspond to your lowest nature. There is nothing in the world which has not its origin in you. Many secrets are hidden in you, high ones and low ones, and when misery and disaster follow in the wake of your headlong rush into

nature you can only blame your own careless ignorance."

The Redemption of Matter

We can see the whole of creation as forming the foundation for man. There is the mineral world, out of which the plant world arises. Would there ever have been all the profusion of living formations with flowers and fruits, if the Earth had not let them go, so to speak, with a selfless gesture? Arise from me! There is the plant world still rooted in the earth, and would the animal world have ever arisen if the living plant had not allowed the giving up of roots? And when we look at the animal world, to which man is so closely linked, would man have been able to arise out of it had they not been prepared to take into themselves his lower nature which would otherwise have hindered him from reaching spiritual heights? There is the rage of the lion, the pride of the eagle, the stolidness of the bull. It is more than a symbol that we meet these beasts as signs for the four Evangelists. The lion rages if we have not his courage, the eagle despises us if we lift our gaze not to higher realms, the bull will gore us if our deeds are not moral but entirely bound to the lower needs of our bodies. And is not the man-angel figure a reminder that within us we combine them all, the beasts and through them the plants, and through them the mineral earth? All this was given to us and then the last gift in addition was the consecrated bread and wine. The time has come when we have to return and redeem the loans. And the interest we have to pay is the recognition of the higher powers which have sacrificed themselves into the lower forms. If we do this the blessing of the liberated powers will be bestowed upon us. The Bread and Wine have metamorphosed our body; it is in our freedom now to make use of them and restore to life those dark realms of nature into which the creative powers have sacrificed themselves for man's sake.

And to this point, we may make one more observation. We have received the last gift and cannot expect to receive another one. We also realise that we are only at the beginning of the long road at the end of which we shall be able to deal with the substances and forces of the

Earth in such a way that their inherent spirituality can once more be fitted into the harmonies of the original creative powers. Our own spiritual powers are still, through the very nature of their present state, only creating dead images as we have seen. But are we not in the same position as the disciples were even after the death and resurrection of Christ? They were still filled with fear. They also were afraid of letting go of their old Adam. They knew that Christ had risen, but they knew it only and it had not come alive in them. This happened only after Christ's ascension and after he had disappeared from their immediate awareness. What came alive in them can also come alive in us, because the Christ power has entered into us.

Yet one could argue that Pentecost just happened to the disciples. I do not think that it was like this, but however it occurred, since then nearly two thousand years have passed and we have entered in the age of evolution when we more and more reject gifts, even spiritual ones, and feel that whatever we do should come out of our own efforts. The strength of our individuality has increased to such an extent that we can maintain this without falling into overbearing pride. We can acknowledge with true humility with Paul: "I, yet not I but the Christ in me." And we may today even metamorphose it without blaspheming: "The Christ in me gives strength to my I." When we act out of this inner awareness, we do so out of freedom. And what does such an act do to our body? It organises it in such a way that the transubstantiation can become an inner living fact. "Do this in remembrance of me." Do this so that my members can come together again in their harmonious unity. And this harmonious unity is none other than the Body Incorruptible.

The act does not remain confined to our body but enters into the world and alters it. When we then take the substances of the Earth into our hands and shape them to our purpose, the Earth will rejoice because it will recognise the dim glimmer of the Christ in our hands, and the first tiny light of Christ will shine in the darkness, the first minute step towards redemption of matter will have been performed.

Books & Journals

Books

THE MYTH OF THE MICRO

by Rodney Dale and Ian Williamson
Star Books (W.H. Allen & Co. Ltd.) 1980 £1.50

"Don't be fooled by Technofear", "Don't let a microchip scare you until you know exactly what it is". Thus reads some of the blurb on the cover of this oddly-titled book. You could be forgiven for thinking that it is an attack on microelectronics—until you opened it. For despite the lively style this is a well-balanced and down-to-earth account of the new microchip technology, written for the absolute beginner or layman; and the authors, both well-qualified in this field, utterly eschew the more sensational and speculative outgrowths of that industry—ultra-intelligent machines behaving as latter-day Frankenstein monsters and the like.

"Our sense of wonder is proportional to our sense of understanding" say the authors, and they foster this understanding through readable and entertaining chapters on practically every aspect of microprocessors and computers, from chip manufacture to programming. Simple, clear illustrations support the text. The history of computing is portrayed as a history of surprise advancements, making any attempts at futurology a folly. The question of 'artificial intelligence' receives refreshing treatment, in a chapter headed 'The Unintelligent Machine'. An analysis of present-day concepts of human intelligence and creativity show it to have little in common with the workings of a computer. The latter does not even reflect the creative intelligence of its designer, but uses sheer 'brute force' and 'number-crunching' to achieve its end. The authors thus transcend the usual 'behavioural' view of computers, but avoid—perhaps wisely in this context—the almost intractable questions of inwardness and consciousness, which can only be illuminated by spiritual knowledge.

Howard Smith

ENGINEER THROUGH THE LOOKING GLASS

by Eric Laithwaite
BBC, 1980, £8.25

This book should appeal to teachers as well as, more generally, to anyone interested in the inventive and enquiring mind. It is based on the 1974 Royal Institution Christmas lectures, given by the author, who is also well known for his pioneer work on the linear electric motor. Many unusual and surprising phenomena are presented in an entertaining and instructive way, including: effects with mirrors, the surfaces of Möbius solids, left and right handed whelk shells, magnetic rivers, gyroscopes, etc. Prof. Laithwaite has a great respect for Nature as the Master-Inventor, a subject on which he elaborated on other occasions. (I related his discussion of 'Design in Nature' to some anthroposophical concepts in a letter in the IEE Journal, *Electronics & Power*, 22nd Feb. 1973.)*

* Divine nature?

The subject of design in living things, discussed by Prof. E.R. Laithwaite (11th Jan, 1973 E & P, p.17) is important at the present transitional stage of scientific knowledge.

According to some modern schools of thought, as well as to ancient tradition, the study of the organic world provides the key to understanding the inanimate realm. In this view, the living explains the dead, rather than vice versa: form has its origin in movement. The shape and structure of an organism bears the imprint of the flowing forms and rhythms in the water, air and other fluids from which it originates.

Some attentive observers of Nature, today and in earlier times, have developed an organic mode of perception which seeks to discern beyond the outer appearance of, for example, a plant, an organising agency which, in the words of John Ruskin, 'catches out of chaos, charcoal, water, lime and what not, and fastens them into given form' (The queen of the air).

Qualitative differences are discernible between the formative influences operative in different realms of life. Formative activity is also accessible to mathematical study: an interesting approach, based on non-Euclidean, projective geometry, has been developed by G. Adams and O. Whicher.*

The same fundamental method has been applied to the study of the Earth as a whole.** The life processes of, for example, a tree are not complete in themselves; the life of each plant, and of the entire vegetable kingdom, is closely bound up with the great circulatory systems of the planet. The Earth, with its rhythms and 'breathing' processes in air and water, may be regarded as a living

organism, to which the life of each of its creatures is intimately related.

This approach is in accord with the current trend towards wider outlooks, and the inclusion of human factors, in science and technology. It leads, among other things, to a new concept of electricity.***

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- * Whicher, O.: *Projective Geometry* Rudolf Steiner Press, 1971
- ** Wachsmuth, G.: *Erde und Mensch*, Philosophisch-Anthroposophischer Verlag, Dornach, 1952
- *** Gange, H.G.: *Profane profit*, Electron. & Pwr., 1972, 18, p.275.

*Re-produced from Electronics and Power 22nd Feb 1980
by permission of the Institute of Electrical Engineers.*

Journals

MATHEMATISCH-PHYSIKALISCHE KORRESPONDENZ

Dornach No.121 (Michaelmas 1981)

This issue is concerned chiefly with astronomy. The main article, 'Planetary paths as rotating lemniscates', by Hermann Bauer, is descriptive and mathematical with several pages of diagrams. This is introduced by Georg Unger, who includes a re-print of a 1967 article by Suso Vetter 'On the lemniscatory Sun/Earth motion after the work of Joachim Schultz'. The articles include numerous references to Steiner and others. A discussion of 'Precession and the Platonic year' includes an interesting mathematical relationship between the duration of the Platonic year and the sidereal revolutionary periods of each of the eight planets. The issue concludes with notes on the comprehensive list of the scientific works of the late George Adams.

Hedley Gange

MEETING THE THIRD MILLENIUM is a journal concerned with the problems of today and tomorrow, with emphasis on the approaching crisis felt by many to be at the end of this century. A wide range of topics is covered, the contributors often drawing on an Anthroposophical background.

Vol.1 No.1 appeared Autumn 1980 and has sold out. No.2 (Spring 1981) contains, among other items, a critical review of the book *The Earthquake Generation* which describes how psychic predictions (by Edgar Cayce and more recent people) of impending cataclysmic earth movements show a significant uniformity; and an account of how a group in Switzerland are

studying the impact of microelectronics and attempting to bring esoteric knowledge to bear on a new understanding of its mode of action.

Vol.2 No.1 (which includes an article on Astrology, and one on Teilhard de Chardin) is obtainable now from: Roma Browne, 2 Riverside, Forest Row, Sussex; or from Rudolf Steiner Bookshop, 38 Museum Street, London WC1. Price 60p. in the U.K., 80p. overseas. Cheques etc. payable to Joan Brinch.

Howard Smith

PLANETARY ASSOCIATION FOR CLEAN ENERGY NEWSLETTER

The Association is non-profit making and aims to facilitate the discovery, research, development and evaluation of clean energy systems. The term 'energy' can have application in both the physical and metaphysical sense. 'Clean energy' embraces systems which draw on natural supply, which are of universal technological application, which are inexpensive and which do not cause polluting residue. The Association serves as a monitor and alerter of 'unclean energy systems'.

The February 1981 issue of the Newsletter (Vol. 2, Nos. 4 & 5) contains practical proposals for the implementation of clean energy policies and an examination of the economics of producing energy from renewable biomass (involving, for example, the fermentation of sugar) in America and elsewhere. Less directly connected with the energy problem are articles dealing with research on 'Internal Symmetries of Physics and Parapsychology' and 'Communication (crosstalk) between Organic

Molecules'.

The biological and other effects of electric power lines and of several forms of Extreme Low Frequency (ELF) electromagnetic radiation are also discussed. Possible (unintended) meteorological effects of twelve ELF transmitters (using the range 100-5000 Hz) located at a research station at Tromso, Norway are considered. These transmissions, which are directed to the ionosphere, are said to have features in common with experiments carried out by Nikola Tesla at Colorado Springs early this century.

The Newsletter also includes, among other things, a report of a 'Tachyon-field' Energy Conference at Hannover in November 1980. This refers to a machine, producing electricity from magnetism, in which the output energy exceeds the input (an efficiency of 300%), and to a device constructed in Japan in which an electric field is fed into a Möbius coil, causing the field to become 'encaged', resulting in the emission of a 'tachyon' beam capable of melting steel, at a higher energy level than the input.

A short article by Trevor James Constable elaborates on the description of a Cloudbuster as 'a projector of etheric forces—the force that Dr. Wilhelm Reich called orgone energy'.

The Newsletter is published four times a year by the Planetary Association for Clean Energy, Inc., 100 Bronson Ave., Suite 1001, Ottawa, Ontario, Canada, K1R 6G8.

Hedley Gange

OMEGA NEWS is a four page broadsheet concerned with the new consciousness in religion, science, medicine and the arts. Its focus is Christian and concerned with the search for a holistic, creative and intuitive approach to life through the practice of meditation and spiritual disciplines. It includes short articles, news items and book reviews—some of the latter dealing with such books as Fritjof Capra's *The Tao of Physics*. It is published bi-monthly by the Omega Trust, the first issue appearing Jan/Feb 1981. Price 10p per issue from: Omega Trust Publications, Kent House, Cambden Park, Tunbridge Wells, Kent. The Omega Order was founded by Peter Spinks who, before becoming a canon of Coventry Cathedral, was for three years warden of the Burrswood Healing Centre

in Kent. (See *Anthroposophical Review*, Winter/Spring 1981, p. 36, 'Spiritual Man in a New Age')

Howard Smith

ELEMENTE DER NATURWISSENSCHAFT No.34 (1981)

Published twice yearly by Philosophisch-Anthroposophischer Verlag, Goetheanum, Dornach, Switzerland.

This issue contains the following articles:

Manfred von Mackensen: A qualitative study of very elementary optical phenomena involving a single lens, with the emphasis on a Goethean interpretation. This work is another contribution to the development of the Waldorf School curriculum, with which Dr. von Mackensen has been closely involved in recent years.

Peter Cornelius: An historical summary of the conflict between Newton's and Goethe's approach to colour. The controversy apparently involved, amongst other points, the nature of the colours green and purple; simple experiments today can clarify these phenomena and help us to reach a solution.

Henning Kunze: A study of the morphogenic processes in higher plants and simple animals. The movements of single cells and groups of cells is traced during the formative stages of development, in order to clarify the essential differences between formative forces operating in plants and animals.

Armin Scheffler: This is the major article in this issue, and it deals with various types of marsh-land. Geographical, geological, botanical, chemical and other aspects are discussed, and it is shown how raised bogs, flat fens and largely submerged marshes form a threefold 'organism', a part of the total organism of the earth. The metamorphosis of one aspect into the other is illustrated, and the three aspects are shown to have some functional similarity to the threefold human being. The article is well supported with ten photographs of the types of ground discussed.

Howard Smith

The Kinetic Energy of the Blood

The Work of Prof. Leon Manteuffel-Szoegé
Hedley Gange

The editors have received from Irene Wade copies of papers by Prof. Leon Manteuffel-Szoegé, of Warsaw, which deal with some aspects of his work on the movement of the blood. Although these reports are dated 1960-70, and the professor died in 1973, the work does not seem to have become widely known in Britain.

Prof. Manteuffel was inspired to do this work after learning of the thesis advanced by Rudolf Steiner that blood has its own inherent movement. Although he had known of this proposition of Steiner's for many years, it was not until 1956 that he was able to start investigations in his own surgical unit, in Warsaw, aided by a team of thirty, and supported by a grant from the Polish Academy of Sciences. He came to the conclusion, published in the reports, that the blood has its own motive energy, that this energy manifests itself with particular clarity in the venous circulatory system, and that these results may necessitate some modification of the present view of the heart as a pump.

He came to regard blood as a very remarkable liquid: a colloidal suspension of cells, having special physical, chemical and biological properties. 'It is subject to the laws of growth: it differentiates its morphological components; it is extremely active immunologically; in short, it is a tissue similar to other tissues in the body.' Yet in its form, movement and ever-changing state, it is quite different. 'Is it reasonable to suppose that this extraordinary tissue, unique in its kind and most active biologically, is haemodynamically so inert that, so far as its motion is concerned, it behaves similarly to artificial plasma?'

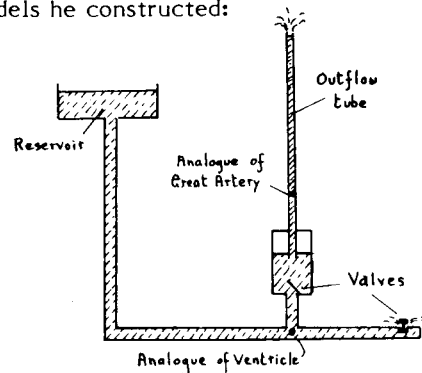
He described the motor energy of the blood as being similar to gravity in that it acted throughout the substance, on every particle, in contrast to mechanical forces that act externally on an object to pull it this way or

that. However, whilst gravity acts always in a downward direction, the energy of the blood is so intimately bound up with the (human or animal) organism that its direction of action depends on the individual requirements of each being.

In 1936, K. Nishi put forward the thesis that the circulation of the blood does not depend entirely on cardiac function, but that it is above all the result of the special property of the capillaries which—in conformity with the laws of physics—suck up the blood and in that way cause its motion. Prof. Manteuffel welcomed this and other efforts to correct the hitherto prevailing opinions on the essential nature of the circulation. He pointed out, however, that there was a fundamental error in the explanation given by Nishi.

Prof. Manteuffel's investigations involved clinical observations of abnormal and pathological conditions, experiments with animals, and the construction of mechanical models to simulate the action of the heart.

The mechanical analogy he used was that of the water ram; an idea that had been put forward by Rudolf Steiner and others. This analogy is valid only if the inherent motor energy of the blood has first been established. The diagram shows the principle of one of the models he constructed:



the reservoir provides the energy for the system, whilst the rhythmic action of the valves corresponds to the role of the heart.

Now that the movement of the blood has been studied from this, mainly, surgical standpoint, perhaps other workers will develop a complementary, and no less rigorous, approach to the subject based on Goethean-style observation of living creatures (including man) in their natural surroundings and in their terrestrial and cosmic settings?

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1. Manteuffel-Szoega, L., *Energy Sources of Blood Circulation and the Mechanical Action*

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2. Manteuffel-Szoega, L., *Haemodynamic disturbances in normo and hypothermia with excluded heart and during acute heart muscle failure*, Journal of Cardiovascular Surgery, vol. 4, No. 4 (August 1963).
3. Manteuffel-Szoega, L., *On the Movement of the Blood*, Parts 1, 2 & 3, British Homeopathic Journal (July 1969, Oct. 1969, Jan. 1970).
4. Nishi, K., *Nishi System of Health Engineering*, Tokyo, Maruzen (1936).
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Comment on the Work of Prof. Leon Manteuffel-Szoega

James Dyson

As a medical student in the early 1970's I was struggling to reconcile Rudolf Steiner's indications in the field of physiology with the contemporary teaching in this field. It was during this time that I first read several papers by Prof. Manteuffel.

The impression they gave was one of sound experimental work, well conceived and documented, forming a bridge between the language and methodology of current physiology and one of Steiner's most significant and provocative indications.

The suggestion that it is a misleading analogy to liken the action of the heart to that of a pump is only one among many challenging indications which Steiner gave in the field of physiology and which at the time appeared to be incompatible with generally accepted scientific opinion. Another example is his statement that the so-called 'motor-nerve' in fact fulfil a sensory function within the organism, and do not themselves *initiate* movement in the muscles.

Since Steiner's death, ideas within conventional physiology have become more refined. Although the analogy of the heart to the pump still seems to prevail and is probably still the most widely used model for teaching purposes, experimental physiologists are very

well aware of its limitations. However, attention is still focussed on demonstrating how other mechanically based forces influence blood flow, such as veno-motor tone, surface activity within capillaries, muscle pumps, etc. The fundamental issues therefore remain unchanged, in that a mechanistic interpretation is still assumed. Steiner clearly regarded it as of crucial importance that his indications be actively researched by doctors and scientists committed to developing a Goetheanistic methodology. It was his hope that they would substantiate his statements, and represent them within the main stream of scientific work. This has not happened to the extent he might have hoped; yet Manteuffel's research is an outstanding example of such an endeavour.

The effect that extensive research in this direction might have had is hard to visualize: it could potentially have extended beyond the boundaries of its own particular discipline and exerted a profound influence on the general spiritual and social climate of this century. This possibility arises from the essentially 'moral' quality inherent in any thought that grasps an organic process in its reality. In contrast to an abstract explanation, such a thought (or, better, thought-process) forms a bridge between the

etheric world in nature (the laws governing the life-processes in nature) and man's own etheric constitution, and is an integral part of man's striving for knowledge, both of the world and of his own inner being. As such it is not only of concern to scientists, but forms a fundamental part of the path of inner development for modern man.

One can assume that it was Steiner's hope that the course of scientific research would have been sufficiently fertilized and enlivened by such endeavours to retain its inherent vitality and commitment to the pursuit of truth. However, over half a century later, one is bound to admit that the central question within science is no longer, "Is it true?" but rather "Does it work?"

Ideas which 'work' are exciting in that they appeal to man's desire to control his environment. They can be turned to practical and profitable or even altruistic ends, but they do not involve the inner moral being of man in discerning the laws at work in nature (the so-called 'moral' order of nature). They cannot satisfy man's thirst for self-knowledge. Instead they offer man the possibility of intervening in the order of nature without his being capable of assuming responsibility for such interference.

Ideas which 'work' inevitably have economic consequences. But motives arising solely from the desire for monetary gain, together with the hold they exert on the possibilities of publication, now largely determine the direction of scientific research, rather than a quest for real understanding. What is more, researchers are hardly ever conscious of the implications of this distinction for society generally.

It is not a matter of indifference whether scientific research produces 'truth' or 'power', or power disguised as truth, because the laws man discerns in nature always exert a strong formative power on the shaping of social life, either consciously or unconsciously. Furthermore, they act as models in the

interpretation of human behaviour and social processes. Ideas in the field of natural science such as the 'heart as pump', 'motor-nerves', 'the survival of the fittest', etc., all have their counterparts in the field of social science and since the 1960's one has not had to delve into the literature very deeply to find them! Prof. Manteuffel's work had this climate of opinion as its context; it is to its credit that, at least to some degree, it broke through the conspiracy of silence that exists around such fundamental questions as he is raising.

Bearing in mind that scientific opinion has become more connected to intentionality than insight, it is not, in my view, our primary task to argue against it. By so doing one may be appealing to a sense for the truth, but one is not appealing to the forces which operate in the scientific world. There is, I believe, a more fruitful way to engage our will. If those who believe in the 'heart as a pump' and in 'motor-nerves' shape their social institutions accordingly, it is up to those who hold different views to do likewise. The new social realities which then arise can, in turn, be studied and observed and may reveal laws of a different kind to those which have been described by behaviourist psychologists.

Rudolf Steiner, in re-founding the Anthroposophical Society and in founding the School of Spiritual Science with its Classes and Sections and its conditions of membership, has sown the seeds for such a new social order: a social order in which initiative and responsibility is not centralised and in which financial support may become free from the constraints imposed by the desire for power and control. Only by working for these goals can the conditions be created for such thoughts as those underlying Prof. Manteuffel's work to develop fruitfully as a moral force within society, and, ultimately, for scientific research to become again, a force for truth within the general spiritual life of our age.

Correspondence

USING THE RIGHT ZODIAC

In the zodiac controversy discussed by Nick Kollerstrom in *Science Forum No.2* there is one further aspect which may be pertinent. Maria Thun in her account of the daily sowings which formed the original basis of sowing by the Zodiac makes no mention of any discrepancies between the Virgin and the Scales. She is not the sort of person who would gloss over an anomaly in a sowing made with the moon in the constellation of the Virgin and in the sign of Libra. In most cases of cosmic transition from one state to another there is a stage when the old state is waning and the new one gathering strength: things do not happen with a sudden click as in a machine. In such circumstances it seems to me that the will of the experimenter, generally unconsciously, may come into play. I think it is now accepted in most quarters that the human will can influence biological processes, and I suggest that this factor may be of particular importance during conditions of change in the environment. However uncertain farmers and gardeners might be well advised to sow and cultivate whenever possible while the moon is standing in the middle of the desired constellation (or sign).

John Soper
*The Laurels, Holy Cross Green
Clent, Stourbridge, West Midlands.*

I wonder what makes Nick Kollerstrom think that cosmic powers work symmetrically, or that 'equal intervals' should predominate? The days of summer and winter are not equal, nor the hours of the day and night. The aesthetic measure is not the equal fraction of the metrical mind but the odd figure of the Golden Number. Where does it fit in? He may be surprised that 'the moon will spend some one-and-a-half times as long in the earth constellations as it does in the air constellations'. As a practical grower I am not in the least suprised, as this is necessary for the furtherance of that most important part of the plant—the root, without which we could not

have a 'balanced' growth.

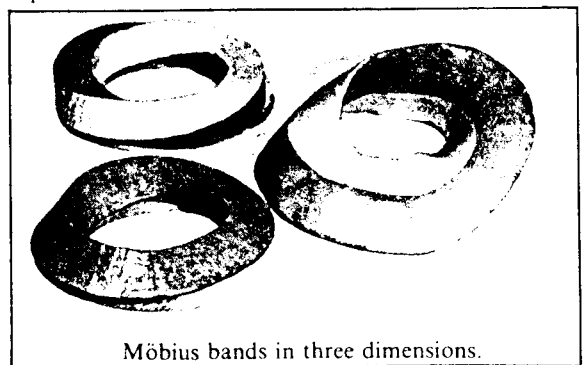
Again, from a practical point of view the farmer and gardner will use 'constellations' because they are what he 'sees'; 'signs' are an abstraction.

When shepherds watched their flocks by night they noted the position of Deneb when the rams were turned in with the ewes; they looked at the constellation of the Swan without bothering whether it occupied more or less than 30%.

George Corrin
*Tynewydd Ketch, Llanfyllin,
Powys, SY22 5EU*

MÖBIUS SOLIDS

In his letter in *Science Forum No.2*, P. Olijnychenko states that he has constructed two solid rings, with square cross-sections, related to the Möbius strip. The idea is that one cuts the ring orthogonal to one of its tangents, twists it and then rejoins the ends. A half twist gives a solid with two edges and two sides. Quarter and three-quarter twists give solids with one edge and one side. Whether or not Olijnychenko was the first to discover these solids is a question I am unable to answer. (Möbius solids are referred to by Eric Laithwaite in *Engineer through the Looking Glass*, BBC, 1980, from which the photograph is reproduced.)



Möbius bands in three dimensions.

photo by permission of B.B.C. Publications

THE SCIENTIFIC AND MEDICAL NETWORK

Dear Editor,

I read with much interest the account of the Scientific and Medical Network by Jean Kollerstrom in *Science Forum No.2*. I was privileged to know the original endeavours to create an association of this kind, bearing in mind that now many scientifically trained people are finding, through their work, the path to the spirit. Two points arise out of this.

Dr. Patrick Shackleton and George Blaker were close friends of my dear friend and guide Father Andrew Glazeski. When I first met this highly evolved human soul in 1966, he spoke of the 'University of the Spirit', an association of all those scientists who, through their work, found that they reached into the realms of the divinity of Man and God.

Father Andrew, a Roman Catholic Canon, a Ph.D. in physics, a concert pianist, healer, clairvoyant and, when all was said and done, a student of Anthroposophy (which he took very seriously) was full of love and deep concern for the path of Man on Earth.

I would like to say that we must not forget that this soul was one of the principal originators of the idea that Patrick and George carry into our present day and beyond.

The second point, which Andrew made, was that we must not, as anthroposophists, forget that the esoteric knowledge which Steiner gave must be shared as and when we meet souls who are obviously ready for this teaching. We should guard against the hoarding of knowledge: knowledge (even esoteric knowledge) that is held back becomes rigid and static. There will always be the need to quietly, carefully guard the source with love, and there are individuals who will do just this.

Theophilus Gimbel,
Director of Research

Hygeia Studios, Avening, Tetbury, Glos.

STANDARDS IN SCIENTIFIC PUBLICATIONS

Your correspondent is right in his view that the new journal *Science Forum* should adopt the standards normal in scientific publications*. May I add that the journal should also only publish critical assessments of experimental work by those competent to judge it. Your correspondent is mistaken when he mentions 'crystallisation experiments with metal salts during planetary conjunctions'. These tests take many hours to develop, and consequently cannot be used as indicators of possible planetary effects. There are no reports of such

The idea can be extended to any ring with a regular polygonal cross-section. If n is the number of sides of the polygon or ring, and t the angle of twist given to the ring, then t values of $360/n$ and $360-360/n$ always gives rise to rings with one surface and one edge.

Polygons with an odd number of sides always produce rings with one surface and one edge for any degree of twist except 0 and 360. Obviously t can only exist as positive integer multiples of $360/n$ for any of the possible ring cases.

Polygons with an even number of sides give rings with different numbers of sides (S) and edges (E), depending upon the degree of twist, according to

$$S = E = n \left(\frac{1}{2} - \frac{|180 - t|}{360} \right) \text{ for } \frac{360}{n} \leq t \leq 360 - \frac{360}{n}$$

the first angle of twist giving $S=E=1$ as already mentioned, increasing by one for each successive increase of twist angle until $t=180$ when $S=E=n/2$. Further increases successively reduce S and E by one, giving symmetry to the twist progression. A ring of octagonal cross-section, for example, with twist angles of 45, 90, 135, 180, 225, 270 and 315 degrees will give $S=E$ values of 1, 2, 3, 4, 3, 2 and 1 respectively.

For the Möbius strip, $n=2$ and $t=180$ giving $S=E=1$, as is well known. As n approaches infinity to give the conventional doughnut then S approaches infinity and E approaches infinity.

Barry Christian

*11 Coppice Close, Stocksbridge,
Sheffield, S30 5LS*

May I amplify on the rings mentioned in my letter in *Science Forum No.2*. The general equations of the edges of such rings are:-

$$p = a + b \cos(m\theta - \theta.)$$
$$z = b \sin(m\theta - \theta.)$$

In particular,

- 1) triangular cross-section (at $\theta = \text{const.}$)
 $m = 1/3$ or $2/3$;
- 2) pentagonal (or pentagram)
 $m = 1/5, 2/5, 3/5, 4/5$
- 3) rectangular, with 2 edges (or square, mentioned in my letter)
 $m = 1/2, \theta = 0$ and $\theta = \beta \leq \pi/2$
- 4) $m = 1/2$; regular shape of the Möbius surface itself, the cross-section is a straight line segment.

P. Olijnychenko.
(Address supplied)

experiments in the extensive literature on the subject. The experiments to which he refers must have been carried out by means of the capillary-dynamic method. L. Kolisko first made such experiments more than fifty years ago. These have been successfully repeated over and over again, and reports published in England, Germany, Switzerland as well as in France, where the physics professor in one of the universities constructed an apparatus to make the test with mechanical precision.

The doubts raised by your correspondent bring us to a question of fundamental importance. We are agreed that we should apply Goethe's method in our research, but surely we must go further than he was able to go in his day. The method, to quote Nick Thomas (*Science Forum No.2*, p.27) "proposes to perceive the active laws of Nature through accurate observation of phenomena." Your correspondent does just the reverse. He prefers to 'explain' the phenomenon that appears in spheres outside his experience as the result of wishful thinking (able to effect chemical processes!) or of deliberate manipulation. In any case he rejects the phenomenon, probably because it does not fit his conception of what 'ought to happen' although he seems to have no experience in the field in question. As for conjunctions or any other constellations, he would find on going into the matter that the heavenly bodies do not move with clockwork precision. They often arrive at a given point before or after the 'scheduled time' printed in ephemerides. By means of elaborate methods of correction it is possible to work with the system, even to land at chosen spots on distant planets. As for experimental work, how otherwise than by observing the phenomena over the years, can we find out which of the several methods of calculation comes nearest to the time at which a constellation is likely to become effective, for instance, in the plant kingdom? How else can we learn that the effects of constellations between the same two planets vary in strength and duration of effect according to the accompanying circumstances in the sky?

A word on 'successful repetition'. Research of this kind must of necessity be carried on for many years, and few people are prepared to work over such long periods. Before accepting the claims (usually of amateurs) to have repeated experiments without results, the critic should check the facts. Generally he will find that the method has been altered, and fundamental directives given in the original report completely or partially disregarded.

Let us by all means exercise critical judgement. In the endeavour to produce

something 'Goetheanistic' a good deal quite without value' has been printed in various places. May the editors of *Science Forum* remain discriminating enough to sift the wheat from the chaff.

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THE ROLE OF THINKING IN SCIENCE

Regarding 'The Role of Thinking in Science' (N. Thomas, *Science Forum No.2*, p.26)—the description given of 'ideal empiricism', including the example of observing successive weather conditions 'and then metamorphosing the separate pictures into each other...', leaves me mystified as how this differs from induction. If it does not differ then philosophically, at least, it may be safely disregarded.

Secondly, may I point out that in his eagerness to be both 'scientific' and 'spiritual', Nick Thomas is in serious danger of falling between two stools. On the one hand, he wants to eschew 'all explanations which are untestable and infinitely modifiable (such as 'vital body' or 'magic')'. On the other hand, he rejects the importance of Popperian 'objective logical relations' in favour of Kuhnian-cum-Wittgensteinian relativism, whereby 'the acceptance of a theory to any degree remains an individual act of judgement by each member of the scientific community concerned' (my emphasis).

I am afraid that, good intentions notwithstanding, you simply cannot have it both ways! Not, at least, without specifying the inter-relationship and relative priority of each approach. Lakatos and Stegmüller have tried to do this, in 'orthodox' philosophy of science; but how would an anthroposophical approach proceed?

Patrick Curry
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Dear Patrick Curry,

Thank you for your interesting letter and observations. First induction! I realize that this is a vexed subject. I understand it to mean that if a phenomenon is observed many times (how many?) in given circumstances then it is inferred as a law. (Whatever that is. I do not believe current scientific philosophy knows concretely.) It is a rather vague notion, although it is often dressed in formal and impressive language. Hume's criticism of induction stands essentially unrefuted (successfully) as far as I know. The essential point is that the

phenomenon must always be the same for induction to be invoked, properly so called. On the other hand, the procedure I referred to is essentially different, for its aim is to learn to apprehend a formative principle behind phenomena that is never mechanically the same and expresses itself in development and metamorphosis, not only in repetition. As examples, through induction we infer gravity, through Goethean observation the 'Urplant'.

I would like to hear your account of exactly how you would describe the successive weather conditions case in terms of induction.

Concerning your comment about 'falling between two stools', I only appear to do so, I believe, if the objective reality of thinking as an effective process is not appreciated. My intention was to indicate that it is possible to be scientific about spiritual matters, and that indeed our ordinary scientific procedures themselves rest on an unacknowledged spiritual basis (i.e. thinking). Good intentions are not in question really. The discipline of accurate thinking is strenuous and exacting, and the vital issue is not one of academic comparison of different views, but whether we really can know anything, and whether that knowledge matters in itself (i.e. apart from its application). This is particularly relevant to obtaining a true knowledge of man.

Nick Thomas
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SCIENCE FORUM

I have now received the first two issues of *Science Forum*. I must say how much I appreciate this new venture and would like to congratulate all involved in producing something which, to me at least, feels so very necessary. What I find particularly refreshing is that the journal provides a medium to air different points of view (as on the nuclear energy question), and one can perceive, by the qualities of the thoughts expressed, the hurdle (as I understand it), which is to overcome theorizing with 'thought-percepts'. Also, it is very healthy to have a medium where contributors can voice their areas of unclarity.

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STEINER'S LIGHT COURSE

Sixty years ago today, that is, on 8th of August 1921, some twenty months after the *Light Course* had been given, there was a

discussion following some contributions by a physicist Fr. Dr. Rabel, and a concluding address by Rudolf Steiner describing the attitude and intentions with which the lectures of the course had been given. (This is now being printed as a foreword to the 1964 edition of the *Light Course*.) From this it is clear that he claimed to have done no more than give a sketch of the new approach which a student of spiritual science must take towards the familiar experiments in Light and Colour. The most sweeping assertion that he makes is that all the recent phenomena of light and colour which have been discovered will, if understood in the right way, fall into line with the fundamental thoughts of Goethe's theory of colour. It is important to bear this in mind when we study the *Light Course*, because the lectures contain a number of statements which, if approached with the mechanistic kind of thinking in which we have been educated, do not appear to make sense at all.

Here we should remember that Rudolf Steiner was dependent on the teachers at the Waldorf School for the experiments which were demonstrated. He did not have the opportunity to put his statements to the test by using different forms of the same experiment. He spoke out of what he saw at the moment, rather than out of carefully sifted pieces of evidence from a whole series of experiments. On one occasion two years later, after several evenings of careful experimenting with the help of a group of friends, he admitted that his original statement about the coloured shadows had been wrong and that Goethe had been right after all. For me personally this does not detract from the fundamental truths which he was trying to convey. It only shows that in these technical matters he was as dependent as anyone else on the results of experiment and observation. What really matters is the quality and the direction of his thinking, and it is this that we should try to feel and to follow. I can truthfully say that in the forty years during which I have made repeated experiments in this field I have not found any phenomenon which contradicts the fundamental convictions of Goethe or the spiritual insights of Rudolf Steiner. But much work still has to be done in sharpening our powers of perception and broadening our understanding before we can see clearly what he was trying to convey to us in these lectures.

Michael Wilson
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(Michael Wilson also supplied the following translation of remarks by Rudolf Steiner from the discussions of the 'Dreissigerkreis' in the Stuttgart, relative to the publication of the

"It is a case of you yourselves doing what you consider to be necessary. With the Courses, it would be a case of me having to correct them so that they do not contain things that are nonsense, but things that make sense. There is no getting away from the fact that all these things will have to be made available to a wider public.

The one course dealt with warmth. On the basis of this course a theory of warmth can be written in the way that one is accustomed to. On the basis of the *Light Course* an optics can be written, so that the physicists will see that it is possible to treat such subjects anthroposophically in this way.

Thereby it would become evident that various things have been dealt with cursorily. One will have to consider how to deal with this and that problem from the point of view of the course. The topics in question would have to be so dealt with that, on the basis of these principles, one writes an anthroposophical Optics or Theory of Heat. I have clearly stated this.

It happens time and again that others give their own opinion and then maintain that it was my opinion. I have never stated that this course merely serves to carry out experiments. That is a task that never ends. I do not know why people are always passing on their own opinion to others as if it is something that I have said. One can hear things whether I can have said them or not!"

SCIENTIFIC HYPOTHESES AND ETHERIC FORCES

The question raised by Nick Thomas* as to the wisdom of seeking scientific phenomena relating to etheric forces is understandable from the fact that we are apt to think of these forces in a world apart, accessible only to the seer. As soon as we realize however, that the etheric forces penetrate the physical, that they make use of physical 'carriers', that the life ether is borne by oxygen, the light ether by sulphur and phosphorus, the chemical ether by water, the formative power itself by carbon**, then the question alters. We ask: What experimental conditions are in accordance with the etheric forces, so that they can come to manifestation? First of all, substances must be in solution, secondly this must be brought into movement, if possible through suction rather than pressure, thirdly there should be some degree of chemical reaction, and fourthly the experiment should develop as far as possible two

dimensionally, on surfaces, and in relation to time. Briefly explained, this means setting up exactly the same procedures, carried out with scientific precision under constant physical conditions, where the only variable factor is Time, for instance the moment when a plant is picked, or when two or more metal salt solutions are mixed.

These conditions are found in the only experimental procedure directly suggested by Rudolf Steiner on the basis of supersensible perception. L. Kolisko reports that she was advised to observe the reaction in filter-paper of plant saps with 'salts'. This would enable her to study what were called, without specifying their nature, the formative forces in plants. Owing to the fact that the experimental conditions are 'ideally suited' to the aim, this study can be made without knowing anything of the nature of these forces. The capillary dynamic test, carried out over long periods, shows that the formative forces, to use Steiner's term for what comes to expression in the test, vary in intensity, producing designs of altering complexity, including particular forms that come and go with the passage of time. These forms change with changing planetary positions. This being so, it has proved possible, a month or more in advance, to forecast the probable appearance of a certain phenomenon. A definite connection has been found between this phenomenon and the physical constitution of the saps that produce it. In consequence, such forecasts have proved their practical value in the case of a medicinal plant. The method of forecasting can be learned, as it is based on continued observation of related phenomena at particular times. It has been applied successfully for many years, but makes no claim to infallibility.

The possibilities of the test were found by means of the faculty of super-sensible perception, but the method has not been used up to now to attempt to prove any of Steiner's statements, although test series made for other purposes have brought several remarkable confirmations. One of these is the connection mentioned above between planetary positions and the state of physical matter, in this case the plant sap***.

* Science Forum No.2, p.31 *Scientific hypotheses and etheric forces.*

** Steiner, Rudolf, *Agriculture*, Lecture 3.

*** " " *Entsprechungen zwischen Mikrokosmos and Makrokosmos* Lecture 6, (18.4.1920).

The Electric Current

Hedley Gange

The simple phenomenon of a direct current 'flowing' in a metallic conductor may be viewed from several angles. From the orthodox standpoint, it may be seen in terms of the physical properties of the conductor and the magnetic and other effects produced. For some practical purposes, it may be sufficient to know the resistance of the wire, in ohms, and the value of the current, in amperes. For teaching purposes, the phenomenon may be described in terms of elementary atomic theory and the movement of electrons. For the more advanced student, this approach may be extended to include such concepts as electron shells, energy levels, electron spin and the wave-particles of quantum mechanics. The question may then arise: "Are we here dealing with physical realities or just with useful, hypothetical concepts?" This may lead to considerations of the nature and philosophy of science, as expounded, for example, by Karl Popper.

The electric current may, also, be considered from a wider standpoint. I indicated in a general way, in *Science Forum No. 1* (p.12), how a comprehensive approach to electricity and electrical phenomena could be developed. However, it has to be admitted, first of all, that for most purposes the conventional methods are indispensable. At the same time, whilst making use of them, it is possible to introduce changes

of emphasis, recognize limitations and indicate, where appropriate, how other methods of approach could be developed to complement and throw light on existing methods.

From this wider standpoint, it is important to establish, in the case under consideration, how the phenomenon of an electric current in a conductor presents itself to direct observation (or as closely as possible to direct observation). The main purpose of this note is to consider this aspect of the electric current.

Two, rather different, descriptions of this process have been given.

Description 1

In his book *Man or Matter*, Ernst Lehrs develops the concept of the electric current by considering first the condition where two bodies, one charged positively and the other negatively, are connected by a conductor. A momentary current flows, and the charges disappear. The only difference between this and the direct current condition is that, in the latter, the electric potential difference between the two bodies (or poles of the supply) is continuously being re-established from an external source.

When a conductor is connected between the two poles of a supply, the electric field, which previously existed between them, suddenly

disappears: in its place, two complementary fields appear, one thermal, the other magnetic. "Clearly, one of them represents the Levity part and the other the Gravity part of the vanished electric field."* Following the cancellation of the electric field, a magnetic field appears as one half of the complete happening, the other half consisting of the thermal field. "The direction of the thermal field as much as that of the magnetic is determined by its having as its axis the conductor joining the poles of the antecedent electric field. Both fields supplement each other in that the thermal radiation forms the radii which belong to the circular magnetic lines-of-force surrounding the conductor."** It is in the direction at right angles to the conductor that the transformation of the electric into the thermo-magnetic condition takes place. There is an essential difference between the heat produced in this way and that set free by combustion. Since the thermal field is one half of the complete happening, the other half of which (magnetism) has a polarized form, the heat itself is not pure Levity either. This accounts for the fact (to which some people are sensitive) that electrically-produced heat has a different quality from other forms of heat. (For a fuller description, see chapter XIII of *Man or Matter*, 2nd ed.)

Description 2

This does not introduce the concept of the transformation of an electric field into two other types of field. The most directly observed features are:

(i) as soon as the circuit is completed, a magnetic field can be detected at a point P, for example, in the vicinity of the conductor. There appears to be a direct relationship between the value of the current and the intensity of the

magnetic field at P. This can be investigated by considering several cases, using different supply voltages or different conductor resistances.

(ii) the conductor begins to get warm. Heat is transmitted from the conductor to its surroundings, and can be detected at P: this process takes place in accordance with the usual laws relating to the transfer of heat from a hot body to its surroundings. The heat produced in the conductor can be shown to be proportional to the square of the current (I^2R).

This description does not regard the magnetic field and heat appearing at point P as arising together, as complementary 'halves', out of an antecedent electric field. Within the conductor, heat appears as part of a process in which electricity 'disappears' and magnetism arises. Heat generated in this way seems to have its own 'quality'.

Conclusion

In "Vom Bilden physikalischer Begriffe", Part 2, Dr. G. Unger does not make use of the 'field-transformation' concept when dealing with the electric current. Also, he places less emphasis than Dr. Lehrs on the importance of the field concept generally, referring to both electric and magnetic fields as 'pseudo-phenomena'***.

In the view of the writer, Description 2 accords more nearly with the Goethean ideal of 'reading' directly from the phenomenon. Others will, no doubt, wish to make their own observations and judgment.

References:

- * E. Lehrs, *Man or Matter*, 2nd ed., 1958, p.276.
- ** *ibid*, p.277.
- *** G. Unger, *Vom Bilden physikalischer Begriffe*, part 2, pp. 89-95, 115 (note 6).

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