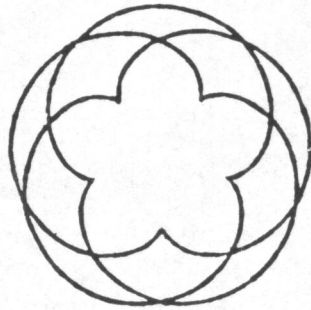


SCIENCE FORUM



Published by the Science Group of the
Anthroposophical Society in Great Britain

Nº7

(AUTUMN 1987)

Science Forum is edited by Howard Smith and Hedley Gange and is the official organ of the Science Group of the Anthroposophical Society in Great Britain. It aims to publish lectures and other contributions from science conferences organised by the Group, as well as articles, reviews, research reports, correspondence and other items of interest.

The editors would be pleased to receive such items for consideration (typed, preferably 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.

Back Numbers:

Single copies Science Forum (Nos. 1 to 5): £1.25 including postage.

Single copies Science Forum No. 6: £2.00 including postage.

Complete set of six back issues: £7.50 including postage.

Additional copies of Science Forum No. 7 are also available from:

Rudolf Steiner Press Mail Order Service

38 Museum Street, London WC1A 1LP

Cheques should be made payable to:

'Rudolf Steiner Mail Order'

Editorial

Agnes Fyfe

Agnes Fyfe, who died on 9 September 1986, aged 88, took a special interest in *Science Forum*. In addition to her published letters (*Science Forum* No.2) and her article in *Science Forum* No.6, she supplied numerous items of information and suggestions. She was particularly concerned that developments in Anthroposophical science taking place elsewhere in Europe should be known in Britain.

Her outstanding contribution was in the field of capillary dynamolysis. The pioneering work of L. Kolisko indicated a wide range of future possibilities for the method. This needed to be followed by a process of consolidation and a detailed specification of the operations involved in the method. These tasks were taken up by Agnes Fyfe with enthusiasm and dedication: She also carried out her own researches, concerned particularly with the influence of the planets on plant growth.

Lili Kolisko's vision of the role of capillary dynamolysis does not yet seem to have been realized entirely, but the historical importance of the work of Agnes Fyfe remains, whatever the future of the method may be.

In *Science Forum* No.4 we published William Steffen's account of his investigation of the physico-chemical basis of capillary dynamolysis. A later article, by Agnes Fyfe, appeared in *Science Forum* No.6. In the present issue of *Science Forum*, we include a translation of an article by Dr. Paul Balthasar, in response to William Steffen's work, which appeared in *Element der Naturwissenschaft* No.44. The three authors approach the subject from standpoints which differ in some respects, and we hope, in future, to achieve a constructive inter-relationship of the three approaches.

Formative Forces

The concept of formative forces

(agencies or activities) is met at every turn in Anthroposophical science—in capillary dynamolysis, in the study of the etheric realm, in the contemplation of Nature and the work of the elemental beings, in the medical view of the human organism. This issue of *Science Forum* includes articles by three researchers in the field of organic form—the relationship between fluid morphodynamics and organic form by Philip Kilner, further investigation of the forms of plant buds by Lawrence Edwards, and *Forms and Rhythms of the Spine* by John Wilkes.

The widening field of interest, study and research suggests a need for a co-ordinated approach to the study of the principles of formative activity. Individual paths of research are still at a tentative stage, but it will be helpful if a more general, comprehensive approach can be developed at the same time.

The Contemporary Scene

We live in a time of rapid change. Change brings problems. Some of the Book Reviews in this issue give a glimpse of the contemporary scene. In this complex and changing situation, there is no substitute for actual involvement and experience: detached observation, as a spectator, will not suffice. This does not preclude progress under more secluded conditions as well. But, as one reviewer writes, "If anthroposophists withdraw in a sectarian way into a separate culture where they do not encounter other ideas, they will fail."

A Science Exhibition

An exhibition of scientific and anthroposophical interest is being assembled by June Woodger. Will anyone who is able to offer any items for inclusion in the exhibition please contact:

June Woodger,
1 Stoneborough Lane,
Budleigh Salterton,
Devon EX9 6HL.

Contents

The 1986 Science Conference

Hedley Gange & Carolyn Hood p. 2

Variations in the Forms of Plant Buds

Lawrence Edwards p. 4

A Note on Capillary Dynamolysis

Hedley Gange p. 12

Form out of Flowing Movement — 2

Philip Kilner p. 13

Forms and Rhythms of the Spine

John Wilkes p. 16

Books and Journals

The Illusionists p. 21
The Sun p. 22
The Anthropic Cosmological Principle p. 23
Some Book Notes p. 24
Die Drei p. 25

Reply to William Steffen: Investigation of the Experimental and Physico-Chemical Basis of Capillary Dynamolysis

Paul Balthasar p. 26

Further Notes on Holistic Science

Hedley Gange p. 31

Subscriptions p. 32

Made and printed in Great Britain
by Camphill Press, Botton Village
Danby, Whitby, North Yorkshire YO21 2NJ

The 1986 Science Conference

Hedley Gange and Carolyn Hood

Discussions, lectures, artistic activity and informal contacts and renewals combined to make the Science Conference held at Wynstones House, Brookthorpe, from 2nd to 5th January 1986, an enjoyable and rewarding occasion. There were three main lectures, four short contributions, clay modelling under the guidance of John Wilkes and study sessions on Steiner's *Boundaries of Natural Science* led by Frances Woolls. A summary of the opening lecture, by Stephen Moore-Bridger, is given below:

★ ★ ★

The Rhythm of Scientific Research

If we want to fertilize modern life through Anthroposophical insights into Nature, we will need to found academies devoted to changing our own selves in such a way that new insights into man's connection with Nature become possible, and lead to a new consciousness of our integral and individual relation to the whole world.

The preparation has three steps. See Steiner's *Mystery Centres*, Lecture 1.

1. *The Philosophy of Freedom* can be used as an intense meditation book for the *experience* of thinking. The first chapters can lead to a perception of thinking separating itself from the world, finding its *own* being in its isolation (beginning of Chapter 4) and then reuniting with its own individual experiences (percepts) in each human being (forming of representations, concepts and sciences *a posteriori*).

In the second half of the book, self-knowing thinking learns how to *act* in

the world, to create in each human being.

2. Through experience of its own memory life (in the way outlined in *Mystery Centres*, Lecture 1), one can liberate oneself from attachment to past experience of earthly life, and learn to use this past experience as an organ through which to observe the world. The past experience creates the division between itself and the world, but thinking does not feel constrained by this division. This non-division, or dividing and re-uniting, becomes immediate perception when the *desire* for separation is overcome. This means refraining from 'thinking' during the actual process of observation: to observe without the observer.

3. This leads to a new sort of action. By experience of world as *gesture* (e.g. eurythmy, or as outlined in *Mystery Centres*, Lecture 1) the world of Nature and man can be experienced as World-will.

Intensive work together is needed by

those interested in these areas.

Natural science today is generally asking (consciously or unconsciously): What is the world *out there?* i.e. separate from the human consciousness and thinking which considers it. But there *is* no such world separate from man. Man's natural being is part of Nature (Eve). Man's spiritual being is part of the creative source of Nature (Adam).

Anthroposophy can endow science with consciousness that man is both spiritually and naturally part of the world, the growing point of the universe where spirit and Nature meet, or where world spirit confronts its own past and acts on it.

In each separate man, there lives as individual spirit the next deed of that power which was the Father of Nature and of man as separate being. Each man can therefore live as the whole world (Christ).

Stephen Moore-Bridger

★ ★ ★

June Woodger combined her interest in botany with that in meteorology under the heading:

The Breathing Rhythm of the Earth and the Ranunculaceae

The year as a whole may be seen as an etheric plant process with its mineral, root (life ether) aspect in winter, vegetative watery aspect in spring, flowering (airy and light ether) aspect in summer and fruiting warmth aspect in autumn.

The Ranunculaceae are particularly sensitive to the elements of water and air; in their wide variety of forms and metamorphoses of forms their intense relationship to moisture and light can be seen. Meteorology and the plant world meet in Ranunculaceae. In this relationship is reflected the breathing out and in again by the Earth of the chemical ether.

The chemical ether is a totality in *time*—past and future—which come together in the rhythm of the year which, though always changing (through the seasons) is always the same rhythm. In winter the chemical ether is drawn down into the earth—ice and snow are the solid state of water, the Earth has breathed in. But out of the 'dead' of winter bloom the Hellebores, followed as the moisture fixed in the earth is freed from frozen, by the Winter Aconites and Wood Anemones. As water flows and light increases the ditches are bright with Celandines, then Marsh

Marigolds along the streams and the Spring is taken over by Buttercups. Living in sunlight and damp meadows, Buttercups show the harmonious working together of sun and moon forces. In May the Globe Flower, though water-loving, shows an airier element through its delicate scent. The Earth breathes out and the rising of the chemical ether is reflected in the red flowers and scent of the Peony, created out of the air and warmth of summer.

At Midsummer the chemical ether has been completely breathed out and the Ranunculaceae show a dramatic change.

Flowers have horizontal axes reaching out to the insect world, as in the Aquilega. Larkspurs and Delphiniums show more rigid forms and fast vertical growth, the form culminating in Monkshood, with its flowerheads moulded to the form of the visiting insect. Monkshood comes into bloom when cosmic astralisation of the atmosphere reaches its highest point.

As the Earth begins to inhale again, the warmth aspect appears in the dry seed pods of Ranunculaceae, and the Wild Clematis flowers—a woody climber showing a strong relationship to the earth towards which the chemical ether is being drawn. Through autumn its flowering continues, the blooms almost metamorphosing into flowerlike seed-heads as winter approaches and the flowers of the Hellebore (the Christmas Rose) bring the year to an end—and to a new beginning.

June Woodger

★ ★ ★

The third main lecture was given by Lawrence Edwards, who described the latest developments in his research on the shapes of plant buds. The content of this lecture, together with the results of some more recent observations, are contained in the article Variations in the Forms of Plant Buds on page 4

★ ★ ★

Short Contributions

Nick Thomas's contribution was of particular interest to mathematicians:

The Nature of Force Fields

The work previously reported by Nick Thomas on the way space and counter-space may be seen to work together to produce the bud and vortex path-curve forms studied by Lawrence Edwards in Nature was briefly recapitulated. The application of the same approach to describe fields of force was then suggested. This is an open area of research, so suggestions rather than solutions were presented. The projective transformation that produces the bud forms is from a certain point of view non-degenerate, for the characteristic roots of the matrix describing the transformation are all distinct. Special transformations are obtained when two or more of

these roots are the same. For example a radial expansion from a point occurs when three coincide, the path-curves becoming the star of lines in the point. This is reminiscent of the scientific picture of, for example, an electric field. The hypothetical lines of force become the path-'curves', which would be properly curved for more than one interacting electrostatic source. The transformation moves points along these lines, and planes orthogonal to them 'rotate' about a line at infinity. Perhaps the normal fiction of lines of force can be understood as relating to a field of pure movement from which force originates when the movement is prevented. The relation of space and counterspace proposed could apply in this case, in which the use of linear complexes to describe forces would become significant. The approach to non-conservative fields such as magnetic fields was also considered briefly.

N.C.T.

The Role of Number

Ron Jarman spoke of the role of Number in our experience of the world, in its many aspects. Calculations may be made in different ways, using, perhaps, circular or hyperbolic functions. In ancient times, number had religious associations. Pythagoras described the magical properties of certain numbers. But the influence of number may also, in some circumstances, be Ahrimanic.

The realm of number can be a world in itself, but it can also help towards a true understanding and experience of life. Pure mathematical ways of thinking can help in the observation and experience of the rhythms of the stars and planets. Life abounds with rhythms: number can play a vital part in the understanding of rhythm and its relation to life.

Are Etheric Forces Formative?

Hedley Gange asked: While it may be true that no formative activity takes place in the phenomenal world without the involvement of the etheric forces, is it right to say that the etheric forces themselves provide the formative impulses? The continuing use of the term 'etheric formative forces' tends to give this impression, as also do earlier descriptions of specific formative tendencies associated with each of the four ethers.

Our direct observation and intuitive judgement of phenomena involving, for example, heat or light should give some indication of their innate qualities. The role of etheric forces in living organisms may be complex, but some general observations are possible.

Heat can encourage growth and the unfolding of organic form—but it may also have the opposite effect, the dissolving and disappearance of form. The general concept 'heat' may perhaps suggest a radiating outwards, but not any specific shape or form.

Light is closely associated with living processes and the building up of form and structure. But under the same conditions of light, quite different forms and processes may arise.

In the realm of substance, copper and lead, for example, have different physical and chemical properties, and are evidently differently constituted from the etheric standpoint. But the determining factors, associated with their essential characteristics, come from beyond the etheric realm.

The study of formative forces is basic in Anthroposophical science. It is important, after sixty years of development, that the fundamentals of formative activity should be clearly understood.

(Hedley Gange also referred to 'Anthroposophical Science in a Wider Context'. An article developed from this talk, 'Further Notes on Holistic Science', appears on page 31.)

Clay Modelling

led by John Wilkes

The vertebrae of mammals were examined, and a particular example, that of a cow, was re-created bone-by-bone in clay. In this way, something of the process of design in Nature could become an actual experience. The moulded shapes and interlocking surfaces gave just the required degree of movement whilst retaining the structural functions. Movement, strength and the circulation of living fluids were essential features of the design. One gradually developed the feeling that the *idea* of the creature, with all its functions and possibilities, was the primary underlying factor, preceding the actual embodiment of substance into the finished organism.

John Wilkes further develops this approach in his article on page 16, 'Forms and Rhythms of the Spine'.

Variations in the Forms of Plant Buds

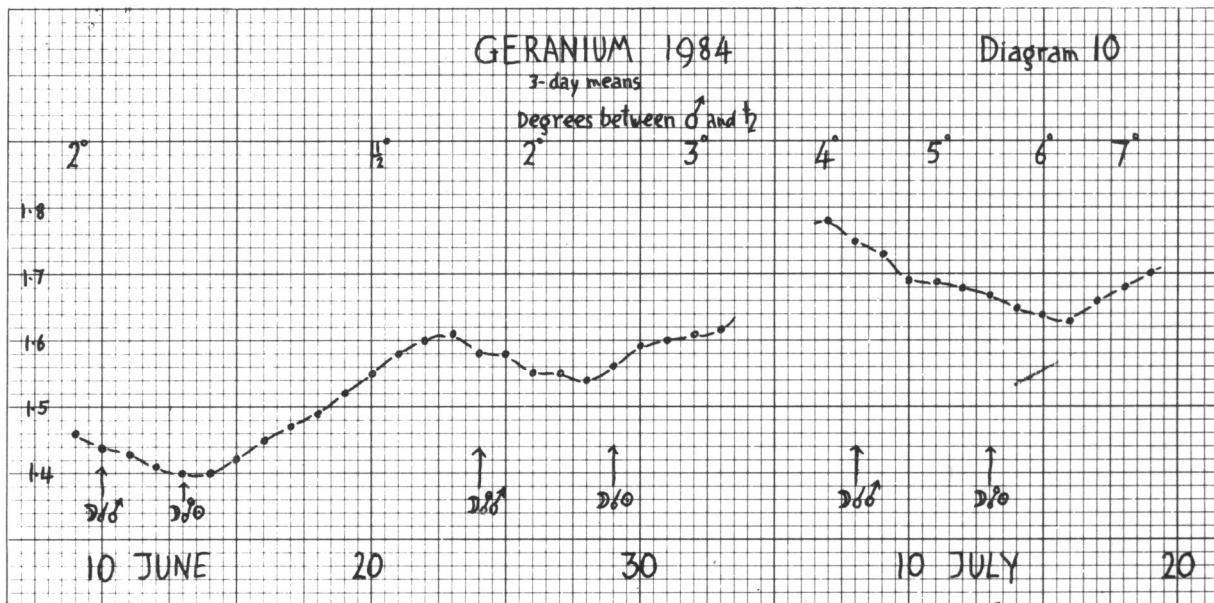
Lawrence Edwards

This account continues the report of work already done, which was published in *Science Forum* No.5 (Spring 1985), and what was there described will be taken as read. Mentions here of diagrams 1 to 9 refer to the diagrams in the previous article. I said there, "One is tempted to make a statement of a general rule: when the ruling planet of the tree comes into alignment with the Moon, the buds undergo a slight decrease in λ —i.e. their form becomes a little more rounded, relaxed, in gesture as though they are taking a tiny step towards opening—and then when the alignment is finished they sink back into a tighter, more closed, gesture". At this point we must remind ourselves of the infinite complexity of the plant kingdom; no rule will be without exceptions; and in the case of certain species the plant's reaction to the alignment is an increase rather than a decrease in λ , but such cases are comparatively rare in the experience gained so far. And it should be

also pointed out that this phenomenon also holds for some (possibly all) species of flower buds. I then went on to say "I believe that this formulation will turn out, in due course, to be a gross over-simplification of a very much more subtle reality, but perhaps it will serve usefully for the moment."

The necessity for this final qualification soon proved itself in the ensuing work, which will now be described chronologically. We refer first to Diagram 7 (Geranium 1983). This graph shows a clearly defined maximum at times of full moon and new moon, but also of Moon aligned with Mars, the latter being close to the Sun at that time. In the summer of 1984 the buds of this species, gathered under identical conditions from the same patch of ground, produced a graph which shows the maxima coinciding with the alignments of Moon and Mars, and not with those of Moon and Sun. But the clear and decisive variation of the previous

year is largely lacking. The first two maxima are only just indicated, and even the third one, which is more strongly seen, is not as marked as those of the year before (Diagram 10). At this time, Mars and Saturn were in close conjunction, and this prompted the speculation that maybe these two planets, which have always been traditionally of such opposite natures, when conjoined, inhibit one another's action. The numbers on Diagram 10 show the distance apart, in degrees of longitude, of these two planets, and it will be seen that strength of variation even remotely resembling that of the previous year is not established until these planets are some 5 degrees apart. In that issue, commenting on Diagram 5 (Stichwort) I had wondered why the variation in 1984 had been so much smaller than in 1983, without being able to put forward a reason for it. But looking back we now find that at that time (May 1984) Mars and Saturn were quite close to one another. If



this is a valid reason, it would seem that Mars inhibits Saturn just as much as Saturn inhibits Mars! Further on in this article it will be seen that this year (1986) yet more evidence has come to support this idea.

The next important step in the work was the daily examination of the buds of yet another Beech tree, all through the winter (except for a short break round about Christmas time) from October to March. Diagram 11 shows the results, which proved of great significance. In general, the results of previous years are completely vindicated; we see a large and clearly defined variation of fortnightly period during the Autumn, dying to very small proportions during midwinter, and then resuming, though not quite as strongly, during February and March. Out of eleven alignments of Moon and Saturn, only one is not clearly acknowledged—that of January 30; and there are no substantial dips in the curve at any other time. The outstanding, and quite unexpected, feature of interest in this graph is that all during that autumn the dips in the curve insisted on coming one and a half to two days early, and by the following spring this tendency to pre-empt the alignment seemed to have increased to about two to two and a half days. At that time I had no indication whether this was an idiosyncrasy of this particular tree, or of that particular season. One simply had to wait for further evidence.

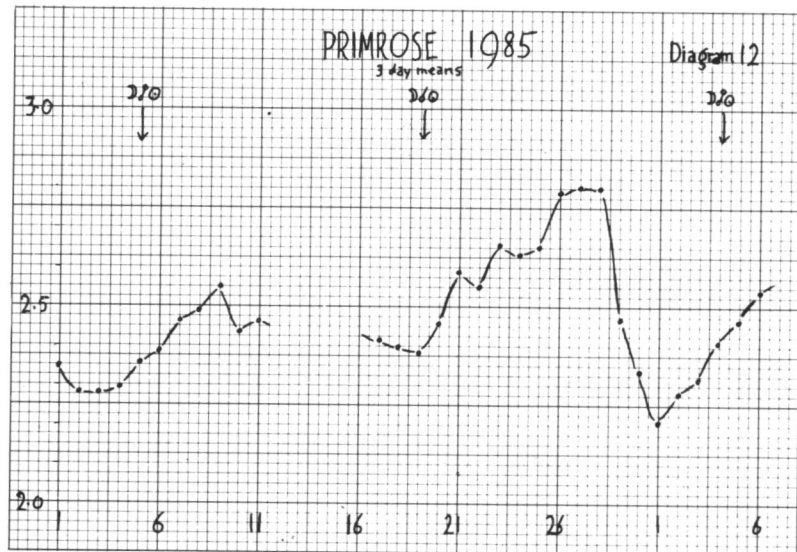
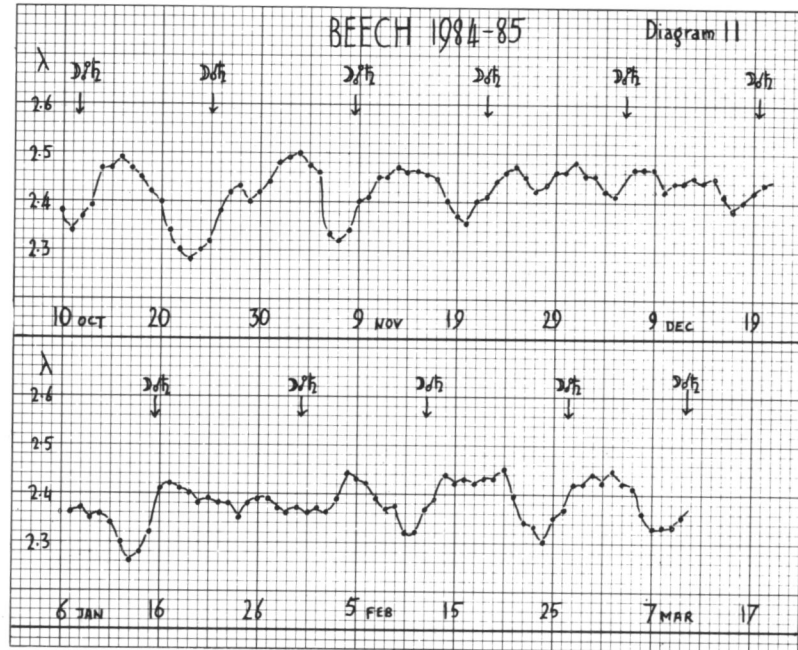
Meanwhile I chose yet another Beech tree for study, during the spring of 1985. It must be reported that this tree did not show any trace of this fortnightly rhythm. Out of many trees studied this is the only one, apart from those growing under the high tension cables, which has given negative results. Further examination, in the rather thick undergrowth on the river bank at this spot, shows that this tree is sharing ground very intimately with a Sycamore. They are growing so closely together that the boles of the two trees are almost wholly united for the first metre above ground level. In the shallow Highland soil, a tree's roots spread out nearly horizontally, and the roots of these two trees must be almost inextricably interwoven. Whether this can be taken as a valid reason why

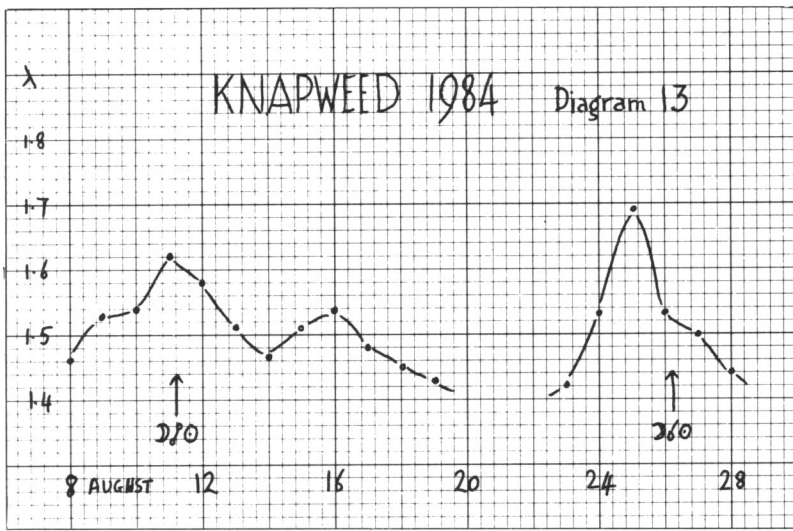
this particular tree apparently cannot respond to its own planetary rhythm is a moot point.

Immediately after the Beech studies which have been described, we have the Primroses of 1985, Diagram 12. If one compares this curve with those of 1983 and 1984 (Diagram 5 of the previous article) one sees that the general features are the same—the curve dips at fortnightly intervals below the level of 2.5, and at no other time. But here the dips come 2 days, 1 day and 3 days early, i.e. before the

Moon/Sun alignments. With the present methods of working it is not possible to time a dip with accuracy greater than plus-or-minus one day, and it seems clear that in 1985 the Primrose was running about two days before its alignments. This was the first indication I had that this might be a general tendency and not one just confined to that Beech tree.

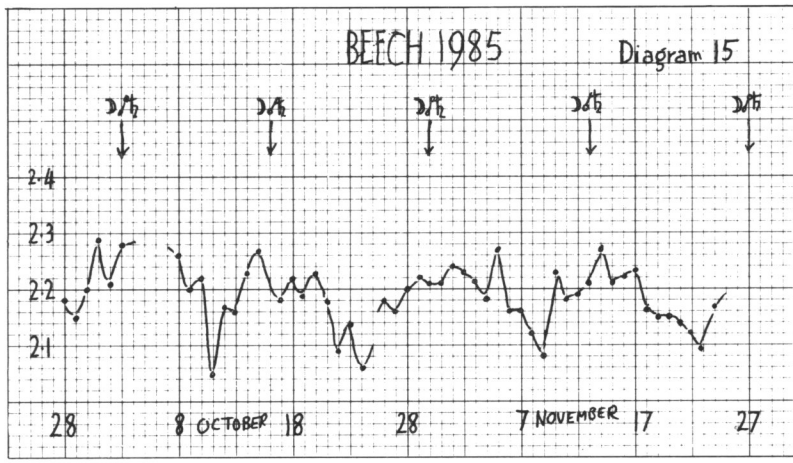
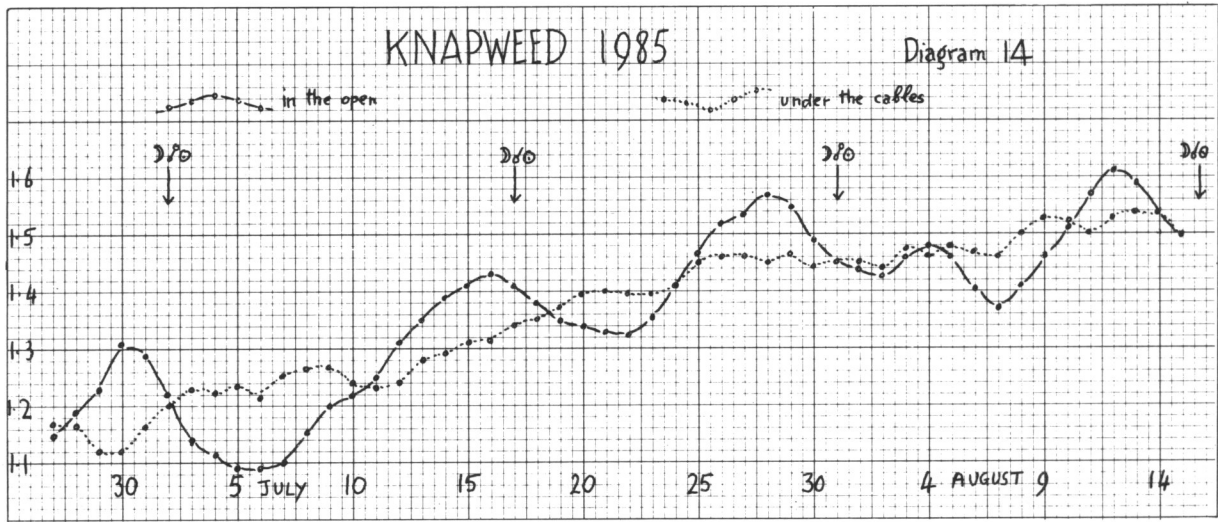
But looking back, with hindsight now, to Diagram 10, one can see this tendency already beginning to show





with the Geranium in the previous summer, although with the somewhat indistinct form of the graph it was not noticed as anything significant at the time.

During the previous summer (1984) I had done a little work with Knapweed. This little thistle-like plant does not have a flower bud in the ordinary sense, but rather, like one of the compositae, a flower head, of many little buds, contained in a little brown casing. This casing has the appearance of a good path curve form, with its hairs growing in perfect spirals around it. Perhaps because it is a composita, its λ behaves differently from that of ordinary flower buds, increasing rather than decreasing as the moment of opening approaches. At this moment a small white or buff



spot appears on the head of the bud, and the appearance of this makes a good identifiable moment of development at which one can pick the buds. But they have already been on the plant for many weeks before this, and during that time their λ has been gradually increasing. Diagram 13 shows the curve for the Knapweed in 1984. So few observations, taken by themselves, could not be considered to be of great significance, but they do seem to indicate a species which comes to a maximum at, or perhaps one day before, the Moon/Sun alignments.

During summer of 1985 I had the opportunity to study this plant over a much longer period. I started as early

as possible, weeks before any one of the buds were mature enough to have developed the white spot; I therefore adopted the policy of choosing each day those buds which were the most mature which I could find, up to and including the stage of developing the white spot. This means that, if there were no heavenly correlation, the curve should show a gradual rise and then level out at the moment when the white spots appear. These plants grow in great profusion over our hillsides, both under the power lines and in the open. I therefore resolved to do two sets, one chosen each day from under the lines, and the other from the open hillsides. The result is shown in Diagram 14. The dotted curve shows the λ for the buds growing under the power lines, and we see that it is in fact a gradually rising curve just as might be expected if there were no heavenly influence. The smooth curve shows the λ of those which were picked on the open ground, and it shows a marked rhythm of approximately 14 days period. It is not quite as regular as many of the other graphs, the maxima coming at 2 days, 1½ days, 3 days and 4 days before the Moon/Sun alignments. It is true to say that, in 1985, this species was running 3, or very nearly 3 days ahead of the alignments, at any rate as a mean figure.

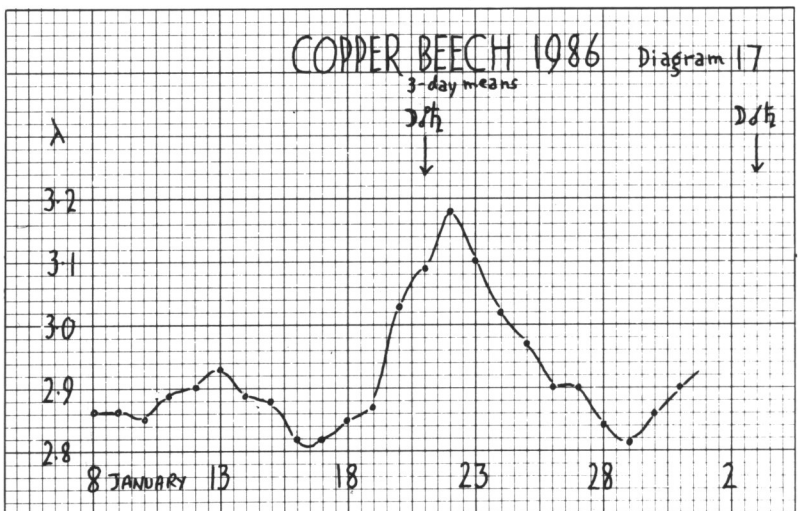
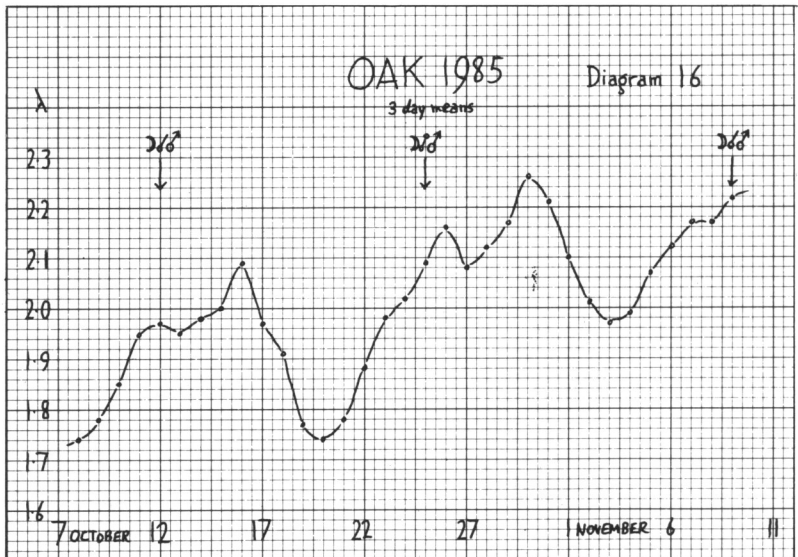
This being so, it was with very great interest that I approached the work on the tree buds for the autumn of 1985. Diagram 15 shows the results for yet another Beech tree, at that time. We see minima coming at 4 days, 5 days, 5 days, 4 days and 4 days before the Moon/Saturn alignments. It is therefore fairly safe to say that in the Autumn of 1985 this Beech was running about 4½ days ahead of the alignments.

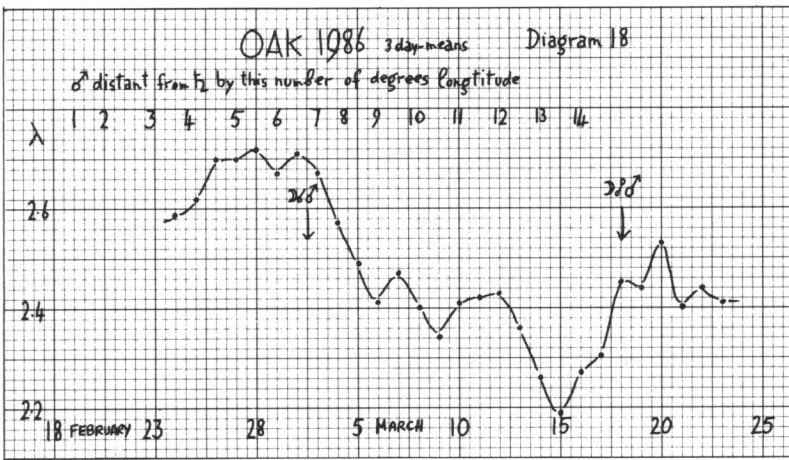
At the same time I did a series for the buds of an Oak tree and the results are shown in Diagram 16. In this work it is important to preserve the very greatest constancy of conditions possible. There are two situations in which such buds can grow—as terminal buds at the end of their twig, or lateral ones on the sides of the twig. I do not believe that there is usually very much difference in their form, but to guard against any suspicion of such differences I always

gather only the one kind on any one exercise. In this case however I started with lateral buds, and then, about January 23, I found these growing rather scarce on my chosen bough, and so switched to terminal ones. This perhaps explains the general increase which shows about that time. Anyway, apart altogether from this, the graph shows three well-marked minima, coming 5 days, 5 days and 6 days before the Moon/Mars alignments. It is safe to say that in the autumn of 1985 this tree was running a full five days ahead of time, and maybe a little more.

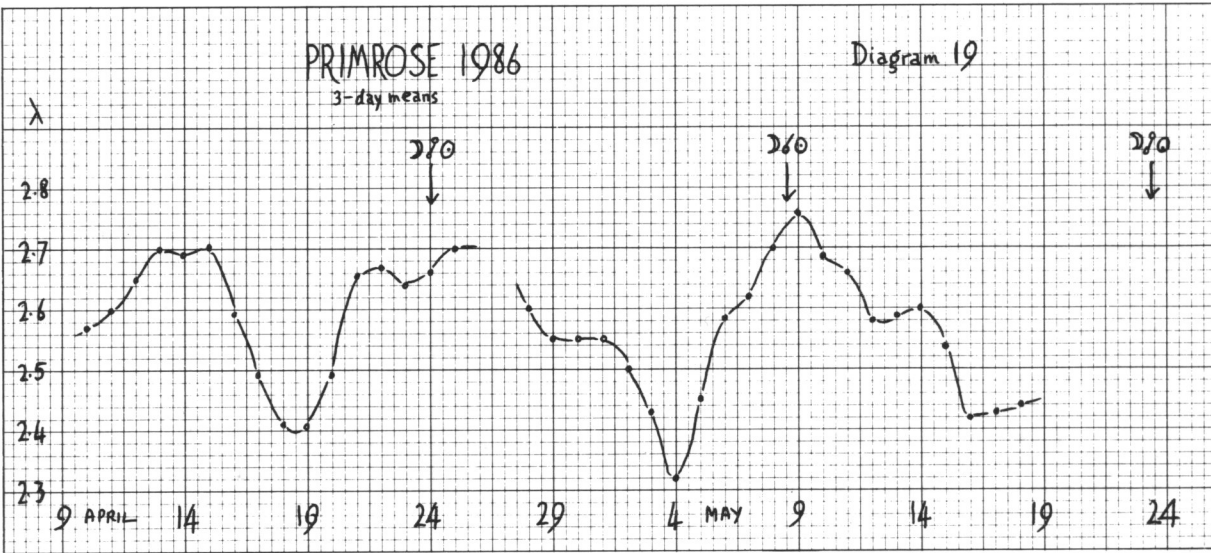
In the spring of 1986 I did a short series on the buds of a Copper Beech (Diagram 17). There were two well-marked minima, coming four and a half days and five days ahead of the Moon/Saturn alignments.

After this I carried out a short series on an oak tree which I have already studied at one time or another. In the usual way the buds of this tree have λ s which vary from about 2.1 to 2.3, with an upper limit at about 2.4. I was therefore surprised to find that these λ s started at 2.7 or more, and not a little chagrined to find that the first Moon/Mars alignment, of March 3,





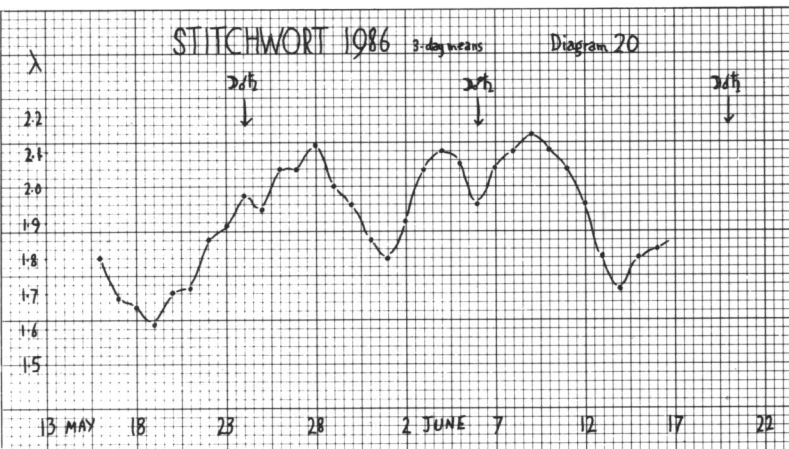
1986, passed without any acknowledgement by the λ -curve. On consulting my ephemeris I found that Mars and Saturn were in fairly close conjunction, and it was not until these planets were separated by some eight degrees of longitude, or more, that the λ -values came down to normal levels, and the fortnightly rhythm set in. Even then, the dip in λ came only three days before the alignment, at a time when most species seem to be running a full five days ahead. Are we to consider that residual effects of the conjunction were still remaining? This is the third case where I have found that the alignment of these two planets seems to have a mutually inhibitory effect,



and I am beginning to think that this is a matter of some real significance. Diagram 18 shows this series, together with the number of degrees separating the two planets on the various days.

Diagram 19 shows the graph for the Primrose, 1986. The general nature of the curve is identical with those of previous years, i.e. λ remains above the 2.5 line, dipping below it only at fortnightly intervals. But now the dips come 5 days, 5 days and 6 days, before the alignments of Moon and Sun.

After the Primroses we have the Stitchwort, 1986, Diagram 20. The graph for this shows the dips coming 5 days, 5 days and 6 days before the alignments. Notice that the degree of



the variation has returned to the high level which it showed in 1983, after its rather poor performance in 1984 (Diagram 5 in *Science Forum* No.5), when Mars was aligned with Saturn.

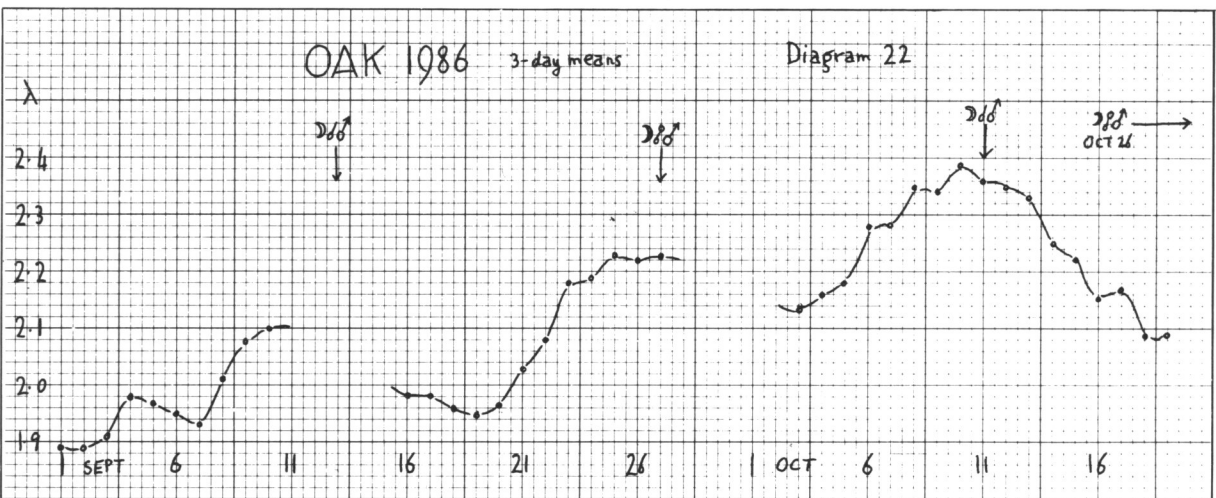
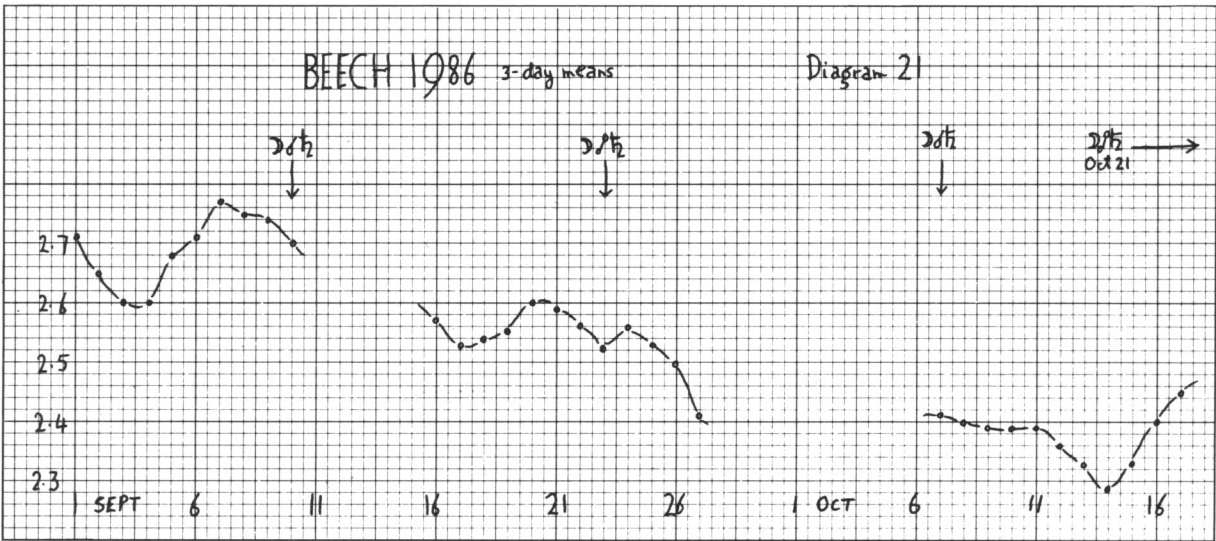
Since then, in the autumn of 1986, I have done series on a Beech and an Oak. Owing to the fact that I would have to be away from home in November I decided to start on these buds a full month earlier than usual—at the start of September, when I have usually considered that they were not yet sufficiently mature for reliable results. What this would mean, as far as the λ 's were concerned I did not know. In the event, with the Beech, it meant that the λ -levels started unusually high, and then dropped stead-

ily during the next four or five weeks. During this period there were four alignments of Moon and Saturn, one of which I missed through a severe bout of 'flu. The other three gave clear dips in the curve 6½ days, 6 days and 7 days early—Diagram 21.

With the Oak, the effect of the early start was just the reverse from that of the Beech. The λ -levels started unusually low, and climbed steadily during the first four or five weeks. There were four alignments, all clearly shown by dips in the curve, 6 days, 8 days and 7 days before the actual alignments—Diagram 22.

To sum up from these various experiences one can perhaps draw

two conclusions. Firstly, the fortnightly rhythm which I reported two years ago has been vindicated in every single case except that of the Beech tree which has become entangled with the Sycamore. Secondly this rhythm seems to be overlaid with a second, slower, and contrary one; and one which seems to be affecting such diverse heavenly bodies as Saturn, Mars and the Sun, in approximately the same way. As the years progress, the dips in the curves are becoming steadily and cumulatively earlier with respect to the dates of the alignments. When the dips are approximately 14 days early, they will again be 'on time' and one half of the cycle of the new rhythm will have



been completed (one half, because the time from one dip to another represents movement from conjunction to opposition). With such frail data to hand it is dangerous to try to predict the period of this new rhythm; but it is too tempting not to try! Obviously only a very approximate figure can be arrived at. In particular it is very difficult to estimate, from the very sparse observations which I was able to make at the beginning of this phase of the work, in 1982, just when the dips were coming exactly in time with the alignments. Some time during the summer or autumn of 1982 would seem to be as good a date as one could find. By the winter of 1986/87 the dips are coming about 7 days early. In about 4½ years the dips are coming about 7 days early. This suggests that a half-cycle would take approximately 9 years, and the whole cycle about 18 years. This latter figure cannot at the moment possibly be considered to have an accuracy greater than plus-or-minus 1½ years; but its closeness to the cycle of the rotation of the lunar nodes is too striking to pass without comment. After another five years' observation we should be able to speak on this matter with greater authority.

This overlaying of one rhythm by another is something which I had not expected. But if Dr. Steiner's words, that the plant kingdom is a reflection of the heavens, are true, then I ought to have expected it. For *all* heavenly movements are compounded in just this complex way. It is counterpoint in the Music of the Spheres—heavenly counterpoint in contrary motion.

We must remember that almost all the figures given in these articles have been arrived at as the means of ten buds picked daily; and whenever we deal with means there is always a certain non-significant variation due to the random picking of the buds; and it is necessary to be sure that the variations we are dealing with are greater than any random variation is likely to be. As an example we will take the last four weeks of Diagram 15. The standard deviation for the ten buds picked on Oct. 29 came out at .088. This is a very typical figure for these buds, and we will use it in the following calculation. The standard deviation for the whole group of ten will be

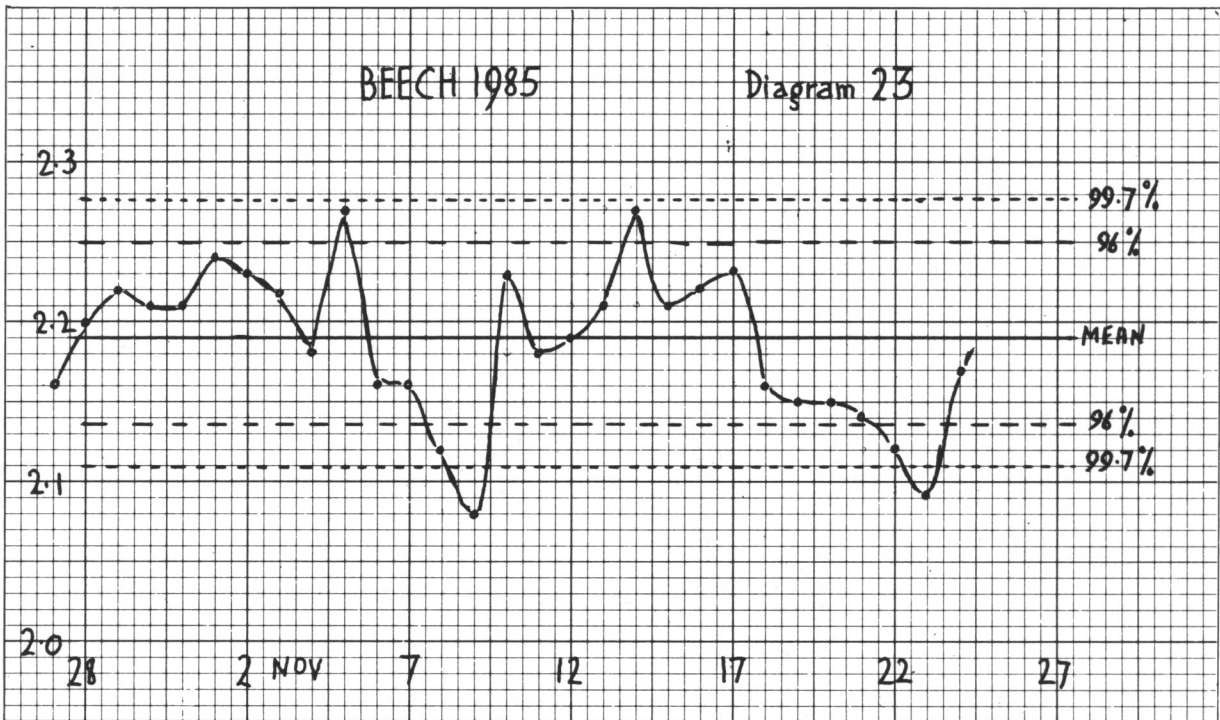
$$\frac{.088}{\sqrt{10}} = .0278$$

and the mean for the whole series is $\lambda = 2.19$

Adding plus-and-minus twice the standard deviation of the group gives us 2.14 and 2.25 as values which can only be reached with 96% probability of significance; and adding plus-and-minus three times the standard deviation gives us 2.11 and 2.27 as values which can only be reached with 99.7% probability of significance. These are shown on Diagram 23 and we see there that at both minima of the curve the dip comes well below the lower limit. The thing is more than 99.7% probably.

This is a generally typical result for all the species described here.

The next question which should concern us here is the following. Since the turning points on the λ -curves no longer coincide with the dates of the alignments, how is it possible to assign to any species a correlation with any particular planet rather than another? The answer is that it is not so easy, and will take a longer and more detailed series of observations before anything like certainty can be arrived at. But it can be attempted. When synchronicity fails us, periodicity is still to our hand. The period of the lunar alignments with the Sun and planets vary somewhat in the course of the months, but



they have well marked and distinctive mean values—as shown in the table below.

Mean Periods of the Lunar Alignments	
Sun, Mercury, Venus	14.77 days
Mars	14.207 days
Jupiter	13.747 days
Saturn	13.695 days

However, the experience of the past few years suggests that the variations in the λ -curve correlate not with the periods of the actual alignments, but with those alignments overlaid with the period of the (backward) movement of the Moon's nodes. We could call these the Nodical Periods of the Alignments. To find them we have to subtract from the above figures one half of the difference between the sidereal and the nodical months, i.e. the time taken by the Moon to traverse the distance travelled by the nodes in 14 days. This is in fact 0.055 of a day. We can then make out the following table:

Mean Nodical Periods of the Lunar Alignments	
Sun, Mercury, Venus ...	14.715 days
Mars	14.152 days
Jupiter	13.692 days
Saturn	13.640 days

Looking at Diagrams 4, 12 and 19 we find four sets of observations for the Primrose (1983-86) and the periods between minima on the graphs come out at, approximately, 15, 15½, 14 and 14½ days, giving a mean of about 14¾ days.

From Diagrams 1, 16 and 22 we find periods for the Oak of 14⅓, 14 and 14 days, giving an approximate mean value of 14 days or maybe very slightly over.

From Diagrams 5 and 20 we find periods for the Stitchwort of about 12½, 14½ and 13 days giving a mean period of approximately 13⅓ days.

From Diagrams 11, 15 and 21 we find periods for the Beech of 13½, 13¾, 13⅓ days, giving an approximate

mean value of 13⅔ days. Working with these figures alone it is clear that the Primrose could only be associated with Sun, Mercury or Venus. The two latter however have periods which are considerably variable from one time to another, and in at least one of the years in question the irregular motion of Venus puts it out of court. It seems probable that the Primrose should be seen as associated with the Sun, but we must remember that Mercury is a possible candidate. More work will be needed to distinguish for certain between these two, on the grounds of periodicity.

It seems clear from the above that the Oak must be seen as associated with Mars, and the Stitchwort and Beech with either Saturn or Jupiter.

Having found approximate periods for the various species it is possible to calculate how many periods are represented by longer stretches of time; and thus to go on to make more exact calculations.

For instance the Primrose has been observed in four different seasons. The first observed dip in the curve came on April 12th 1983 and the most recent on May 17th 1986. This is a space of 1131 days and it is easy to calculate that this represents 77 Primrose cycles. 1131 divided by 77 gives 14.69 as the most exact figure available for the Primrose cycle.

Similarly the Oak observations extend from a dip on November 19th 1982 to one on October 19th 1986, a period of 1430 days, representing 101 Oak cycles. 1430 divided by 101 gives 14.158 days as the exact value for the Oak cycle.

The first and last dips in the curves of the Stitchwort were on May 10th 1983 and June 14th 1986, a space of 1117 days, representing 82 Stitchwort cycles. 1117 divided by 82 gives an exact cycle for the Stitchwort of 13.62 days.

The first and last dips for the Beech came on October 11th 1984 and October 14th 1986, a space of 733

days, representing 54 Beech cycles. 733 divided by 54 gives 13.57 days as the exact Beech cycle.

It will be noticed that none of these exact periods is to be found in the table of Periods of Lunar Alignments as accurately as they all come in the table of Nodical Alignments, where they appear with quite remarkable exactness. Also these figures seem quite strongly to favour Saturn rather than Jupiter for both the Beech and the Stitchwort.

I hope that I, and others, will in due course extend the range of this work to include a broader range of species, but it seems necessary that the work should go ahead somewhat slowly. As far as the flower buds are concerned, it is only possible to proceed, with present methods of working, if the species in question presents one with a clearly identifiable moment of development (such as the first parting of the sepals) at which one can pick the specimens, and for every twenty or thirty buds which one meets, probably only one will be at just this stage—the species must grow liberally in one's neighbourhood. The picking, mounting and photographing of just twenty buds per day, and the consequent minute measuring of forty photographs (they are each photoed twice, from two directions at right angles) constitutes a large part of a day's work. Two species at a time is as much as one can easily handle, and each graph takes weeks, or months, of work. Now that the work is exhibiting hitherto unsuspected complexities, it seems necessary to establish firmly the *principle* of what is at work, before trying to diversify into many other species. And this can best be done by studying comparatively few species, in depth, over many years.

Acknowledgement

Financial assistance received from the Margaret Wilkinson Research Fund is gratefully acknowledged.

A Note on Capillary Dynamolysis

Hedley Gange

The following details relating to two aspects of capillary dynamolysis may perhaps be of interest.

The first concerns the construction, by a physics professor at a French University, of an apparatus to make the CD test with mechanical precision. This was referred to by Agnes Fyfe in her letter, in *Science Forum* No.3, p.28. After publication of the letter, Miss Fyfe kindly supplied further information and a picture of the apparatus (Fig. 1).

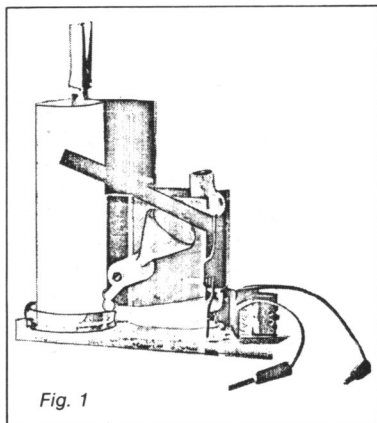


Fig. 1

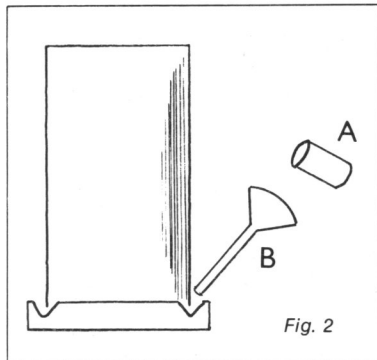


Fig. 2

The sketch, Fig. 2, indicates the principle of operation of the apparatus. A solution of, for example, silver nitrate, is first prepared, at A; this is then tipped into the funnel B which conveys the liquid to the base of the cylinder of filter paper. Each test is carried out under specified conditions of ambient temperature, humidity, illumination and time duration.

Agnes Fyfe explained that the professor had constructed the apparatus to

allow comparisons to be made between the results of using mechanically precise processes with those obtained by the normal, manual method. Apparently the critics had suggested that the use of the apparatus would produce more consistent results. However the comparison showed that test series carried out with the apparatus "were just as variable as those made by hand at the same time."

The second point refers to the origin of capillary dynamolysis. Statements available in English do not give a clear picture of the historical situation. Some relevant extracts are given below.

F. Carlgren, *Rudolf Steiner*, p.39: "Some scientists decided [in the early 1920's] to investigate these [etheric formative] forces experimentally. A few laboratories were founded, among them that of Dr. G. Wachsmuth and Dr. E. Pfeiffer at Dornach. Following Rudolf Steiner's advice two experimental methods were developed, Capillary Dynamolysis, by L. Kolisko, and the Crystallisation Method by E. Pfeiffer. Already during Rudolf Steiner's lifetime quite a number of the first results of these experiments were published."

A. Fyfe, *Science Forum* No.3, p.30: "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 These conditions are found in the only experimental procedure directly suggested by Rudolf Steiner on the basis of super-sensible perception."

E. and L. Kolisko, *Agriculture of Tomorrow*, p.118: "This method, which we call Capillary Dynamolysis has been developed slowly, during many years of hard work. In 1920 we started with the study of metal salts, in 1923 we proceeded to the study of various plant juices, according to a task which Rudolf Steiner, whose philosophical works are known all over the world, gave to the Biological Institute at the Goetheanum, then working in Stuttgart, and since 1937 trans-

ferred to England. It took a long time until we found the solution to this seemingly simple problem; to study the formative forces in plants with the help of a filter paper test If we take only the plant juices we shall never find the formative forces hidden in the various plants. After having studied thoroughly for years the formative forces hidden in inorganic matter, i.e. in various metal salts and how these metal salts are connected with cosmic forces, we were able to find the solution to the problem given us: the study of the plant formative forces. We found that we had to combine the action of the metal salts with the specific action of the various plant juices."

Stewart C. Easton, *Man and World in the Light of Anthroposophy*, p.476: "..... the system of capillary dynamolysis invented by Lili Kolisko, and developed as a blood test for cancer by Werner Kaelin."

A. Fyfe, *Moon and Plant*, p.9: "In 1923 Rudolf Steiner suggested to L. Kolisko that she should study the formative or etheric forces in plants. She should observe how a drop of the sap of various plants spreads in filter paper at different times." p.10: "A drop of plant sap on filter paper shows very little, so L. Kolisko then proceeded to absorption by capillary attraction, but there was still little form to observe. It was only when she used a reagent in the form of a metal salt solution that structure appeared. The method was worked out and named capillary dynamolysis."

One further observation: the phenomena of capillary attraction and capillary analysis were both known before 1920.

As the above quotation from *Moon and Plant* indicates, the use of a reagent is the characteristic feature of capillary dynamolysis. Would it be correct to say that the method of capillary dynamolysis was not suggested by Rudolf Steiner, although he did advise the use of filter paper to observe the behaviour of drops of plant sap?

Form out of Flowing Movement — 2

Fluid Morphodynamics and Organic Morphogenesis

Philip Kilner

In the first part of this article (*Science Forum* No.5, p.28) I described some simple practical methods for studying formative processes in moving water. The descriptions were of methods rather than results and were offered in the hope that readers would make experiences and observations for themselves.

Study of formative fluid movements, although quite accessible to any interested inquirer, is a field that does not seem to have been adequately recognized or explored in the march of mechanistic science. In fluid mechanics, the crucial work of Osborne Reynolds just over a century ago may have been partly responsible for this. For valid reasons he made certain studies of flow under very restricted conditions. He found that fluid passing continuously through a rigid, uniformly cylindrical tube underwent a relatively sudden transition from laminar flow to turbulence at a certain rate of flow. This was a finding that has proved highly significant in practical fluid engineering, but which may have contributed to the widespread and inadequate assumption that flow is *either* laminar or turbulent. Between these two, various states of transitional flow are actually those that are of the greatest interest in terms of formative fluid movements.

Theodor Schwenk made extensive studies relating to these transitional states of flow, and in his book *Sensitive Chaos* (Rudolf Steiner Press, 1965) he presents photographs of forms arising through the movement of water in Nature and under controlled experimental conditions. His juxtapositions of illustrations and descriptions are stimulating and suggestive. First-hand experimental work adds a great deal to appreciation of his photographs, and raises further questions concerning relationships

between forms arising through flow, erosion, deposition and growth. My intention here is to try to gain an appreciation of the nature of formative fluid processes, and to add certain comments on their relation to organic morphogenesis.

★ ★ ★

Based on observational studies, including those described in my previous article, I would like first to outline a few essential points regarding formative fluid movement:

1. Fluid Morphodynamics.

Fluid forms arise through processes. Movement and form, time and space, are inseparably involved. An appropriate single term for formative movement is *morphodynamics*: movements are forming and forms are moving.

2 Movement & Disturbance.

Water is very sensitive to disturbance, and its movement readily becomes chaotic, or turbulent. To allow more orderly processes to unfold, controlled movement must be carefully induced in a volume of undisturbed, or uniformly moving, water.

3. Scale.

In fluid processes scale is important, in time as well as in space. If either the size or the speed of a formative movement is changed, forms arising may be significantly altered.

4. Invisibility.

The movements of fluids are usually and predominantly invisible. Even when appropriately marked, movements are only locally and partially visible. It is simply not possible to see every portion of three dimen-

sional spacial form at any one moment, let alone at every moment during a process.

5. Flow Visualization.

Different aspects of a particular formative process may be rendered visible by different flow visualization techniques. These may include local introduction of ink, a suspension of particles, a suspension of reflecting metal dust flakes, schlieren optical techniques, or simply observation of reflected light on the free surface of a liquid. Different techniques may seem to give conflicting findings until it is realized that each furnishes limited information relating to the actual morphodynamics of the fluid volume. Variation of approach helps greatly towards recognition of the nature of fluid morphodynamics.

6. Thought.

The nature of fluid morphodynamics is ultimately approachable only through the activity of thought. It is accessible to mobile thought, but eludes rigid conceptualization.

★ ★ ★

Eddies and Vortices

Experimentation using flow visualization techniques soon reveals how readily fluid curls into eddies or vortices. They arise where parts of a fluid volume have different relative velocities, the underlying process being a slipping and rolling of concentric fluid layers, inner layers generally having the greatest rotational speed, intermediate layers, in the absence of central suction, generally having the greatest velocity.

A fundamental form of vortex, arising where a localized, directional impulse moves into a larger fluid volume, is that of an annular vortex,

or vortex ring. A smoke ring in air is a familiar example, but vortex rings also form readily in liquids.

A particular relationship between movement and viscosity is necessary for coherent vortex formation. Where there is little kinetic energy and high viscosity no vortex formation takes place, layers sliding smoothly over one another in linear, as opposed to circular, formation (laminar flow). Where kinetic energy is high and viscosity low, vortices not only form but proliferate in an apparently chaotic manner (turbulence).

In a turbulent fluid the distribution of eddies and vortices may be a tangle of distorted loops, worms and branches, each squirming and rolling within itself. Turbulent flow as described, however, cannot actually be made visible by any single fluid marker technique. Suspended metal dust certainly allows a lively impression of the surfaces of multiple, writhing fluid scrolls, but ink marker, being rapidly dispersed, is useless for visualization of turbulent fluid, this in itself telling us something about the character of its movement.

Trains of Vortices

A typical and more ordered arrangement of eddies, known as a train of vortices, or Karman Street, arises in the wake of an object moving at a certain speed in relation to a fluid volume. If a vertical rod is drawn horizontally through fluid, or if the fluid moves in relation to the rod, vortices are shed, their central axes initially parallel to the rod, and in an alternating sequence of left and right-hand rotation. Here it is apparent that speed is critical: formative movements are quite different at lower or higher speeds (see Fig. 1).

The illustration shows *streamlines*, meaning *imaginary lines whose directions indicate the directions of flow at all points along them at a particular moment*. For stable flow (1a and b) the pattern of streamlines corresponds exactly with path-lines traced by the movements of suspended particles, but for oscillatory flow (1c and d) or turbulence (1e) paths traced by particles at different times will vary, path-lines not being

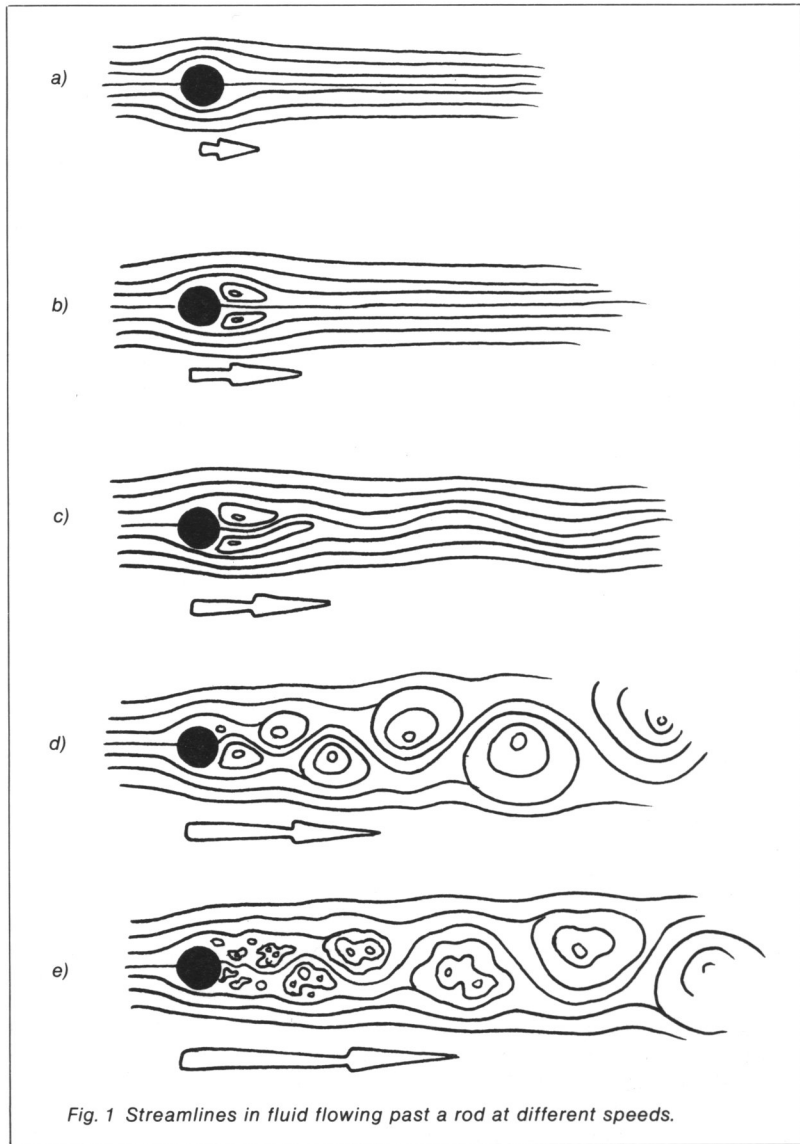


Fig. 1 Streamlines in fluid flowing past a rod at different speeds.

identical to any instantaneous streamline pattern.

As illustrated in Fig.2, streamlines (2b) are not the only way of depicting fluid movement: 2a represents an almost instantaneous 'photograph' of scattered particles moving in the wake of a rod, and gives a useful impression of velocity distribution. In 2c a different method has been used to visualize the very same process; the vortices now appear not as concentric circular formations, but rather as a sequence of spiral forms. These are interesting in that they bear a certain resemblance to embryonic forms. It is instructive to consider

the process by which these spiral forms have arisen: a line of marker has been applied to the fluid surface, and a rod drawn along the line. Deformations of the line, caused by rotations of fluid in the series of vortices, gave rise to the forms seen. These forms represent the shape at which the original line has arrived at a certain time after passage of the rod. Spirals naturally arise where inner layers of vortices rotate more rapidly than outer layers.

Direct comparison of this with the process of animal embryogenesis would appear legitimate, at least at the level of formative movement: a

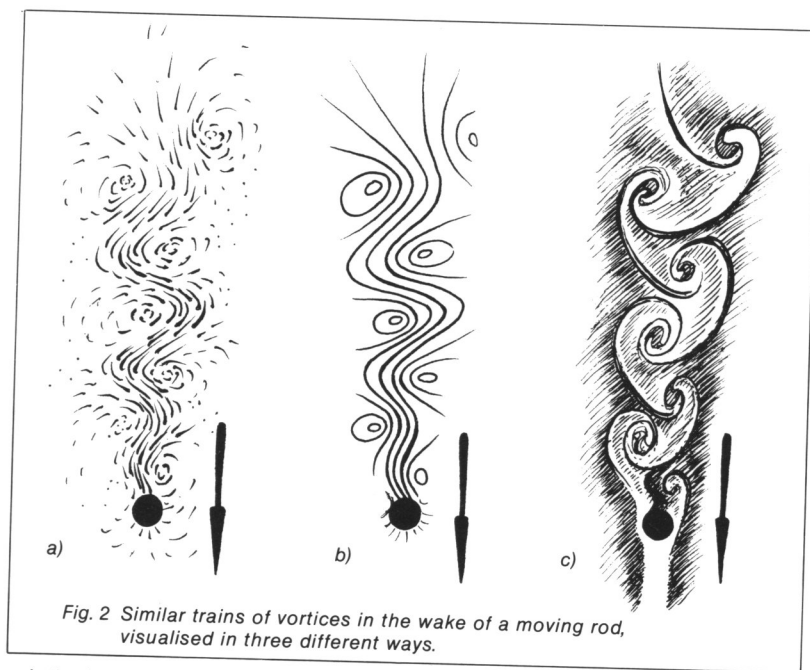


Fig. 2 Similar trains of vortices in the wake of a moving rod, visualised in three different ways.

relatively planar embryonic disc deforms and curls towards a complex three-dimensional form. The outer form of the embryo resulting from the deformation of the original ectoderm layer. But we should also be aware of significant differences between embryonic and fluid morphogenesis: the special and temporal scales involved are different, the embryo being comparatively small and slow, the forces involved probably being of a different nature. Furthermore, embryogenesis includes other formative processes, such as the separation of somites and the penetration of nerve fibres, taking place amidst the overall flowing-growth movement.

Strikingly 'organic' forms may arise through a number of experimental formative processes, which include vibrational processes as developed by Ernst Chladni and, later, Hans Jenny. Comparisons, particularly between single photographs, should be made with care: they could be illuminating or misleading.

Among the photographs in Theodor Schwenk's *Sensitive Chaos* are ones showing, on the one hand, forms of the water surface in a funnel vortex, and, on the other, spiral forms of the shells of sea snails. In terms of form there are striking similarities, but it is worth thinking further about the

processes that underlie the forms. The funnel vortex exists only while dynamic movement continues. The movement involves rotation of a fluid mass, from the centre of which fluid escapes, as down a plughole. The morphology of the water surface might be interpreted in terms of a tension between directional kinetic energy of the moving fluid, viscous cohesive forces, and the action of gravity which gives rise to hydrostatic pressure gradients through the fluid mass. The form of the snail shell, however, has arisen through very different dynamics: calcium carbonate has been progressively deposited out of the living fluid system of a slowly growing mollusc. A complex interplay of metabolic processes were prerequisites of the finished form. The point that I think should be made is that phenomenological comparisons between forms should extend to comparisons of formative processes; assessment of the significance of apparent similarities should, as far as possible, take generative processes into account.

But this does lead to further difficult questions: How are we to approach the real nature of forces participating in formative movements? Even when we speak of physical phenomena in terms of kinetic energy and viscosity, there should be questions as to what

these terms actually mean. How does a mass of substance 'remember' that it is supposed to be moving in a certain direction because it was doing so a moment before? What is the nature of the slippery attractiveness between adjacent parts of a viscous fluid? And what happens in a fluid that is, almost literally, torn asunder by conflicting tendencies or influences?

In fluid morphodynamics there may be a number of thresholds of transition between laminar and turbulent flow. Fig.1 shows progression through five distinct states of flow, each change depending on the establishment of certain turning or dividing points within the pattern of flow, and, at a certain stage, the onset of rhythmical oscillation about a symmetrical state. The presence of these features depends, at least in part, on the state of balance between fluid kinetic energy and viscosity, but more subtle influences may play in, particularly at moments of transition.

If we now consider the interplay of forces involved in slow processes of organic growth, kinetic energy will generally be negligible, but a whole spectrum of physico-chemical forces probably do have participant roles. To search for *causes* of form amongst them may, however, be too limiting an approach; it may be more appropriate to learn to think in terms of an unfolding symphony, an orchestration of movement and processes. This may then be analysed in terms of particular parts played, but also experienced as a whole. As a whole organic form may be recognized as the vehicle and expression of something qualitatively different from the processes and parts that physically bear it. Like musical instruments, organisms employ a range of cyclical processes, but within the medium of water rather than air, enriched by ever mobile biochemical processes.

This analogy allows a modified view of cause and effect: whether you see the music as the outcome of physical processes, or the sounding of physical instruments as result of musical creativity depends on your level of chosen perception. The one level does not exclude, but rather complements the other.

Forms and Rhythms of the Spine

John Wilkes

These are just some tentative ideas, by no means exhaustive, expressed at the January 1986 Science conference. They have come about mainly as a result of preparing and observing anatomical specimens over a number of years. The original purpose of this study was to penetrate questions concerning metamorphosis more deeply. It became evident that rhythm is a major component in all such phenomena which also depend on fluid formative processes for their development. Water plays an essential role, and it is questions about the way water creates forms outside and inside organisms which led to the discovery of the Flow-form Method (*Science Forum* No.3, p.13; No.4, p.16 and No.5, p.12).

The vertebral column of a mammal on its own, such as the Llama illustrated here (Fig. 1), can be reminiscent of a snake or fish. In the mammal, however, there is much more differentiation. A snake is like an elongated rib cage with little variation in the individual bones; the fish (Fig. 2) exhibits a gradual change from the head to the tail as do also the sea mammals. The land mammal's spine shows dramatic sequences of change, presenting groups of bones which in themselves are similar to each other—the lumbar, the dorsal, the cervical.

These dramatic changes are introduced by the presence of the limbs, bringing differentiation into the whole process. A number of further groups can be clearly discerned.

(a) the *sacral bone* beyond the lumbar, supports the pelvis (the number of vertebral bones welded together here varies considerably from species to species);

(b) a very short or long *tail*—from the sacrum to the end of the tail a simplification and contracting process is evident. The tiny end bones show a little column or limb-like bone which disappears as the culmination of a contraction. Beyond the group of similar cervical, or neck bones toward the head are

(c) the *axis and atlas* which belong intimately together—the atlas indeed offers part of itself, its 'column' to the axis, which becomes a pivot on which the axis rotates. The atlas provides a cradle in which

(d) the *occipital* of the skull sits, allowing for a vertical nodding movement. The axis and atlas can be called the 'no' and the 'yes' bones respectively. Forming the base of the skull beyond the occipital are the *first and second sphenoids* and finally the *vomer* with its accompanying *conchae*—the vomer has become so thin

in its convoluted structures and it ultimately stretches forward in a kind of channel until it disappears altogether in expansion, where all evidence of a column has vanished.

The members of this final group (d) of cranial bones are differentiated and thus carry individual names, but form an almost rigid interlocking block.

To illustrate the polarity of the opposite ends of the vertebral column, the last 'column' tail bone can be placed into the 'vessel' channel of the vomer. Apart from the most forward bones in the skull, the column element continues relatively unchanging, contracted, dormant.

In the animal the vertebral column lies generally in the horizontal position. Only in the human being a vertical column, accompanied by transversal and dorsal processes with their changing forms, performs the true supporting function.

All these vertebrae are symmetrical. The column or body of each bone lies along an axis of symmetry. Each bone can be considered as consisting of four parts. The processes; articular, transverse and mamillary, are separate at an early stage in development on either side of the axial plane. They meet only gradually to weld in the dorsal process. These parts of

Fig. 1



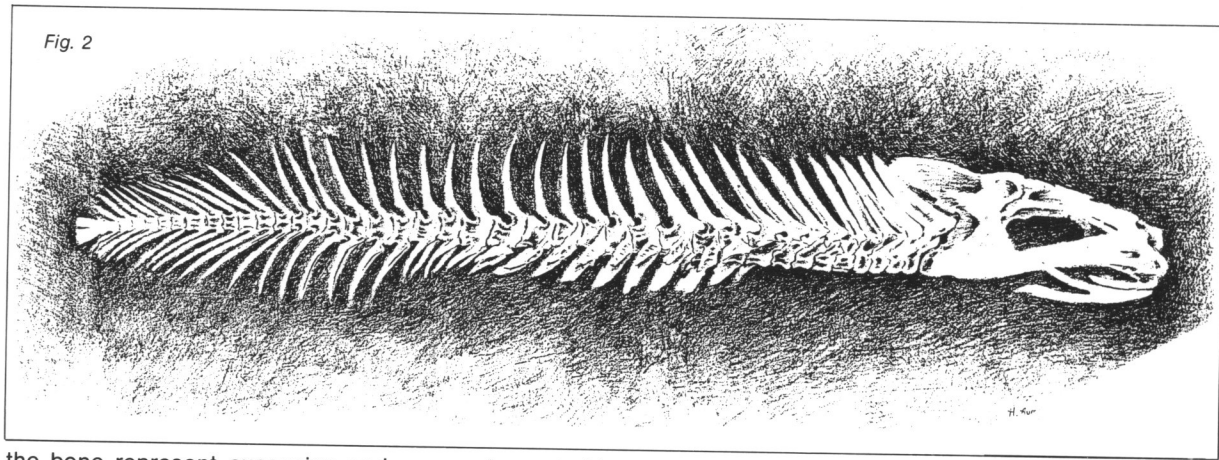
caudal

sacral

lumbar

dorsal

Fig. 2



the bone represent expansion and movement, and this is the part where, naturally, all the changes take place. The body of each bone is symmetrical with axial ridges showing where its halves would have joined. Representing the contracting principle, the body is likely to be united at an earlier stage into one piece.

Each bone represents within itself the polar principles of expansion and contraction. Following this through for all forms of nature it is evident that every physical manifestation owes its existence to contraction and expansion, convex and concave, centric and peripheral, physical and ethereal.

Returning to the idea of the skeletal functions, *support* in the column and limb bone is clear. Manifold aspects of *movement* are allowed in the joints. All the changing forms of the bone processes relate to the anchoring of ligaments and muscles. As these functions of support and movement meet in the vertebral bone a

space is created for the spinal cord—a space as *protection* for a vulnerable organ. Support, movement and protection are the three functions fulfilled by the bone system.

There are thus two ways of looking at the bone forms—fourfold and threefold.

Longitudinally, the metamorphic process unravels from contraction to expansion into the head and back again. The head itself paradoxically represents contraction in the whole organism, while the limbs expand into multiple form which, in detail, are contractive. All the phalanges of hand and foot are small columns or limb bones, like the tail end.

After studying these groups of bones, from the tail or caudal bones, to the sacral, lumbar, dorsal, cervical, axis/atlas, cranial, it can be seen there are clearly seven. It is interesting and perhaps apt in the vertebral column to notice that the developing metamorphic sequence has a link with the sevenfold evolutionary se-

quence. The spine is one of the few examples where a sevenfold nature appears as a statement, since it is usually manifest as a time process.

Rudolf Steiner expressed in an artistic statement the evolutionary time sequence of the earth's development, in the spatial forms of the capitals in the 1st Goetheanum for the very first time.

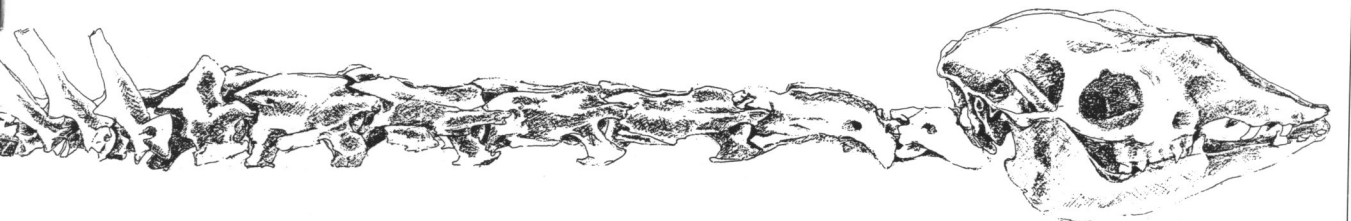
He describes how the sequence is quite subtly mirrored about the centre. There is something of this in the spine:

(a) the cranial bones are expanding but fixed, which is opposite to the contracting but mobile tail,

(b) the hollow ring forms and mobile axis/atlas contrast with the solid and fixed sacrum,

(c) the light spreading out and freely moving cervical counter the heavy and interlocked lumbar,

(d) it is understood that the dorsal maintain a central balanced original form from which all others deviate into specialization as the organism



cervical

axis/atlas

cranial



Fig. 3

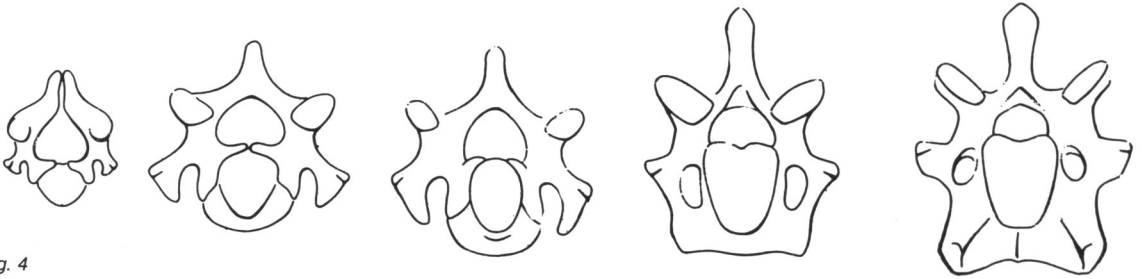


Fig. 4

develops.

Looking at the neck bones of an embryo calf, (Fig. 3) from left to right (seventh to the third) a metamorphic sequence in space is seen. The lower arch of the transverse process of the seventh on the left is open, and progressively closes stage by stage to the right. If the growth in time is recorded, a number of the stages through which, for instance, the sixth vertebra proceeds gives a similar picture (Fig. 4).

Nature reveals, in the physically discontinuous metamorphosis between the vertebrae, something similar to stages in the physically continuous growth process of each vertebra.

The following paragraphs describe a few further random examples.

Jochen Bockemühl (*Elemente der Naturwissenschaft* No.4, 1966) observed, in the physically discontinuous leaf process of the plant (Fig. 5) and the physically continuous growth process within a single leaf (Fig. 6), that the whole plant shows, in reverse order, *metamorphically* a picture of the characteristic stages through which the growing leaf moves, from the shoot through membering to spreading, and lastly stem building.

Hanging up the fish skeleton by the tail a picture of a composite leaf (Fig. 7) is visible. Physically, the growth process emanates from the

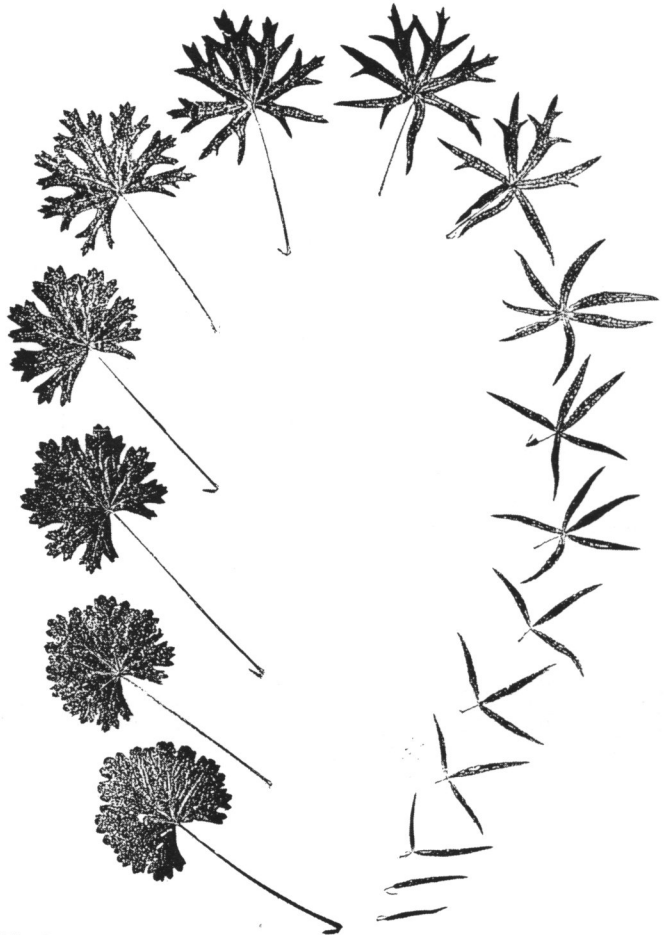


Fig. 5



Fig. 6 (after Bockemühl)

head—the area of the root—and the spine is like a tail to the head, growing out of it. However, the form process enters from the periphery inwards. The outermost forms look the youngest. This is illustrated as described above by the seventh to

the third cervical, where the third has an 'older' form than the seventh. Quite another picture is that of the embryological development of the human arm. It begins as a bud growing from the body. The phalanges are evident at a very early stage as tiny

columns like the end tail bones. The forming process penetrates inwards towards the body as the physical bud grows and stretches outwards. If normal growth is disturbed the formative process cannot penetrate fully, resulting in a relatively well formed

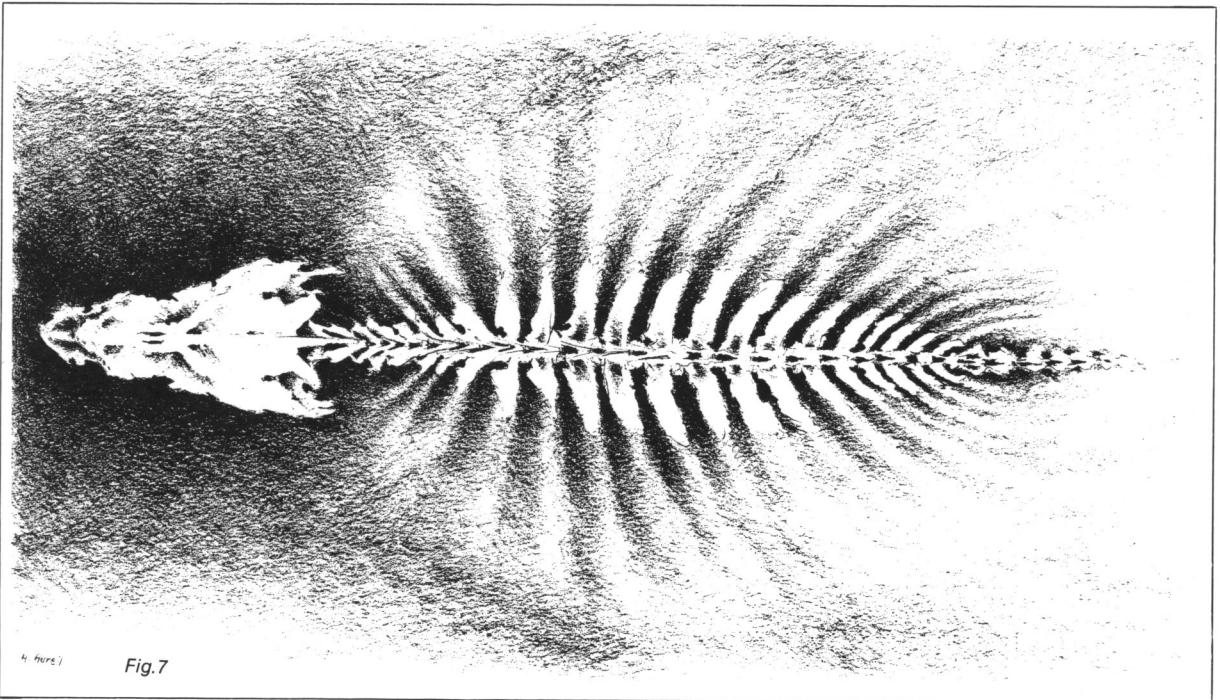


Fig.7

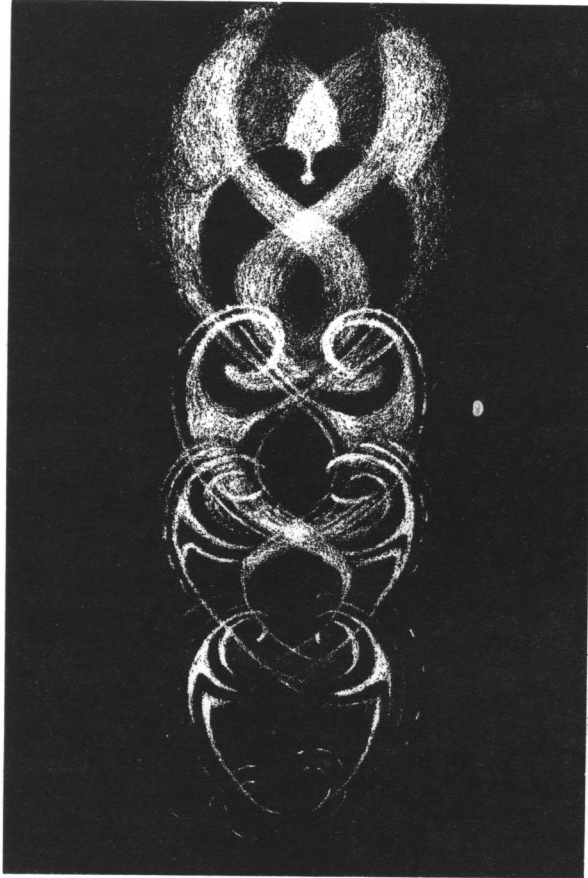


Fig. 8
(freely after Schwenk)



Fig. 9
(after A.J.W.)

hand close to the body.

In creating a path of vortices by passing an object through a shallow dish of water, sometimes forms very reminiscent of a plant appear (Fig. 8). The lower 'leaves' and 'root' are the last forms to mature. Looked at as a picture of the plant, that is from the periphery inwards towards the earth, the movement and form building processes have entered from the direction of the youngest looking forms.

Such a path of vortices can give indications as to the genesis of the spine. To begin with a continuous path of vortices is imagined, its spiraling components gradually separate out as bones. If a mirrored meandering sequence is superimposed, a symmetrical picture of a metamorphic process emerges not far removed from a set of vertebral bones (Fig. 9).

These pictures open up questions concerning form as a consequence of rhythmical and fluid movement processes. Polarity and formative tendencies working in opposite directions combine to build organisms. Changing sequences can be followed up in relationship to other phenomena such as the water cycle which have further implications for our research.

The most recent developments of the sevenfold cascade, illustrated here in two stages (Fig. 10), will be described in a future article. These sequences will be used in a process of rhythm research, which will investigate the inter-relationships of the rhythms generated.

The drawings in this article, Figs. 1, 2, 7, 8, 9, are by Helen Aurell, and Figs. 3, 4, 5, 6, 10, by John Wilkes.

Flow Design Research Group
Emerson College

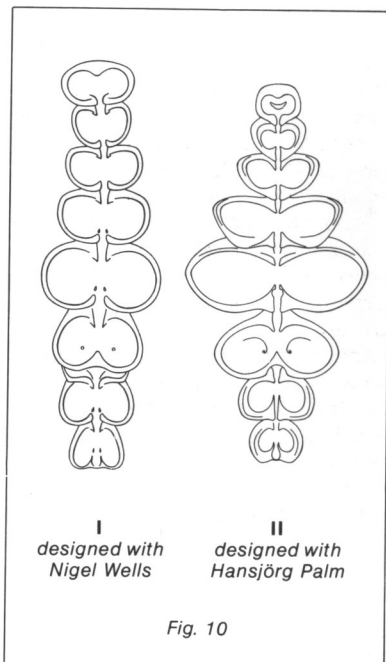


Fig. 10

I
designed with
Nigel Wells

II
designed with
Hansjörg Palm

BOOKS & JOURNALS

The Illusionists (Essay on scientific untruth)

by Pierre Feschotte

Editions de l'Aire, Case postale 45, 1000 Lausanne 21

Pierre Feschotte's book courageously calls into question many of the generally accepted truths inspired by the results of modern science. It consists of a precise analysis of false dogmas arising from misleading simplifications of the results of scientific investigations, promulgated especially by radio, television and the Press. He gives a clear exposition of the source of the concepts and models used in science.

The basic aim of the author is announced in the first chapter: "Everyone who pays attention to the alarming signs which reveal an unrest and fear of the future, especially among young people, will understand the aim of a university professor, after 20 years teaching, to review the question of scientific knowledge and its truthness to life, having regard to the strong influence of scientific dogma on modern thought. No day passes without some discussion of scientific 'truths' which are presented by the media as factual and firmly established. In particular the Darwinian dogma of 'struggle for life'. The human consequences of these ideas are so serious that *the greatest care is needed in their presentation.*"

Scientific results and their false extrapolations quickly invade men's souls and cause a depressing materialistic view of the world, in which *man* is reduced to a complicated chemical machine programmed only by genetic rules, *thought* to a brain excretion, *destiny* to whims of fate, and as a direct consequence *freedom* becomes an illusion.

The author invites us to understand this situation through an investigation based on practical human observation.

The first of the seven chapters, 'Science in Power', describes the present situation in scientific research. Everyone is aware of the huge amount of knowledge of the physical world

turned out by science: it would be impossible to achieve a synthesis of all these specialized pieces of knowledge.

But the most surprising is to imagine that the molecular and atomic concepts we use to describe the physical and chemical world were formulated by Democritus 2500 years ago; and consequently the materialistic theories we use today were set up *before* any scientific investigation (??). The problem is stated in these terms: Does Democritus' concept of matter preclude any other theory or idea about the physical world?

The second chapter, 'The Evolution of Science', describes the origin of modern science. The author explains the artistic, religious and philosophical reasons which led to scientific attitudes towards Nature. The relationship between man and world vastly change: Rudolf Steiner characterized the fifteenth century as the birth of the self-conscious soul (*Bewusstsein*). Man becomes an individual, separates himself from the universe and from traditions that provided support for his existence. Contemplation of the world is gradually replaced by observation of the world. Man wonders about Nature, he then carries out experiments. Subsequently the objects he perceives supplant the idea he originally contemplated; nominalism overrides realism. Eventually, man is permeated by a doubt that his senses are reliable. He replaces qualitative observation by quantitative measuring which requires scientific instruments (microscope and telescope). While his perceptions of the world are becoming fewer and growing poorer, man, in whose soul active-knowledge takes place, excludes himself from the world. "From the argument about the reality of universals—the ideas themselves, or the particular manifestations through which they can be identified, have not been

studied in our time. That is why modern science does not recognize the relationship between thought and experiment which would justify a theory of knowledge."

The third chapter, 'Science and Truth', addresses the question: What is reality? Feschotte invites us to develop a lively and dynamic way of thinking following the Theory of Knowledge expounded by Rudolf Steiner in *Science and Truth* and *The Philosophy of Freedom*. He shows us how to create and control our perceptions. We know that reality does not reside, out of reach, in perceived objects. It is created in our soul, at the meeting point of percept and concept. If reality takes place in man, what is the human meaning of any scientific result? This is expressed by Steiner, in *Science and Truth*: "The elevation of the existential worth of the human being is really the purpose of any science ... What gives sciences their merit is the philosophical explanation of the human meaning of their results."

Clearly a realization of the origin of reality improves our judgement of scientific theories.

The Fourth chapter, 'The Source of Illusion', brings us to the heart of the book. Some established 'truths' or 'models' escape from the very limited field in which they are valid and invade the speculative domain where they appear as 'metascience', for example, the assertions: man is descended from the ape; life on earth evolves from the mineral. These illusions arise from the simplification, and thus impoverishment of specialized scientific information into a form suitable for the media. An example given of an unreal truth is: the reality of the two infinities. The author also examines two concepts which always seem to be under a veil of mist in our consciousness: time and space. The important thing is the consciousness

used by man to consider the, and Feschotte demonstrates how the reality of time and space can be discovered. He concludes: "To assert on behalf of science that man has no significance before this double infinity of space and time *is a real lie.*"

Feschotte quotes the famous French biologist Jean Rostand: "...to sober up when he (man) places his derisive kingdom among the unlimited stars revealed by his telescopes. How could he take himself in any way seriously after contemplating the cold abyss where spiral nebulae are hurrying." To whom he answers, with the audacity of Christopher Columbus flattening his egg on the table, "It is easy to reverse the doubtful assertion 'Man has no significance in the eternal silence of the endless spaces' and, using common sense, to say 'Those tiny phenomena we observe in the sky really have no significance for humanity—no more than elsewhere the quarks and leptons in the laboratories of sub-Nature.'"

The fifth chapter, 'From Hypothesis to Dogma', deals with, among other dogmas, the origin of life on earth. Pierre Feschotte approaches this question from a new angle. He begins with the obvious observation that death prevails in our surrounding physical world. We can easily see the yearly vegetable world's death in autumn, the death of animal species and also our own death. Ecology makes us aware of the death invading our world and threatening man's future. Thus the right question is not 'What is the origin of life?' but 'What is the origin of death?', because life might, *even from the very beginning*, have existed on earth (see St. John's Gospel).

As soon as the question is correctly formulated, correlations are found among many seemingly puzzling results of modern science listed by Feschotte.

The assumption that man is descended from the ape receives special

attention. This is referred by reference to H. Poppelbaum's *Man and Animal, Five ways to Differentiate them*. Of the purpose of human evolution, Feschotte writes: "We can say without any exaggeration that the discovery of a self-thinking man is the main purpose of our present civilization. The human being is based on this self-awareness, and the universe of *knowledge is entirely based on it*, evolving in two rhythms: at first parting from the world and then, with conviction, meeting reality again. By active thinking I produce in my soul a thought which I can also find outside. In this way I can discover the world and its laws which have been hidden from me in mankind's evolution. This is possible through an immediately perceptible act, as a free expression of my being."

The sixth chapter, 'The Price of Freedom', describes the Fall of Man leading not only to modern materialism but also to freedom. Human exclusion from God's bosom (visions of lost Eden or the dismembering of Osiris) and the two ecumenical councils of 553 and 869 AD show us how modern science and its attitude to Nature have developed. This was the price for human freedom and consciousness. Now at last the discovery of the spiritual dimension of the human being is possible, by self-conscious man (due, in particular, to the Spiritual Science of Rudolf Steiner).

Pierre Feschotte also throws new light on pedagogy and ecology given by the idea of reincarnation, (Rudolf Steiner insisted on the evolutionary justification of reincarnation, particularly if we relate animal evolution to the spiritual evolution of man).

The seventh chapter concerns human dignity threatened by a scientific illusion of humanity. Christ's injunction, and St. John's, 'Love one another' can really begin as 'Take a keen interest in each other'.

Remedies for our social diseases

are described, taking into account the positive sympathetic forces of our soul. Examples are given illustrating the kind of behaviour stimulated by pedagogy to balance the negative selfish forces bound to our self-conscious soul. Practical 'Listening to the other' is illustrated in paragraphs on: social co-existence, selfishness and economic life, the causes of school tiredness, etc.

To free science from metascientific illusion is the message of Pierre Feschotte's work. This French humanist, in the 300 pages of his important book, in a way opened by Goethe and Rudolf Steiner, has undertaken the task of finding the reality of the spirit in the human being. Using the two maxims 'Man know thyself' and Science without consciousness brings only ruin of the soul' (Rabelais), this knight of truth pushes the inescapable and essential adversaries of man to their limits. In this way he secures a space of freedom for us, allowing us to face our present difficulties with calmness and clear-mindedness.

(Pierre Feschotte was born in Berne, Switzerland, in 1930. He graduated as an engineer in chemistry (1953) and as a doctor of physical sciences (1962) in Paris. He has been Professor of the Faculty of Sciences at Lausanne University since 1964, where he teaches chemistry and metallurgy. He also lectures on scientific knowledge and its relation to the human being in some French-speaking popular universities in Switzerland.)

The above quotations from Pierre Feschotte's book are my own translations. I hope that my article will convey to English-speaking people (the bearers of the self-conscious soul!) the importance of his work, and perhaps one day we will see *The Illusionists* translated into English.

Dr. Daniel Kmiecik

(Thanks are due to Janice Hutchinson for assistance with the text of this article — Ed.)

The Sun: the ancient mysteries and a new physics

by Georg Blattman — Floris Books, 1985.

Georg Blattman gives us a new vision of the sun and its significance for human life. A clear introduction, very short chapters and numerous illustra-

tions give the book an immediate appeal. The phenomena of the zodiacal light, sunspots, the corona, the interior of the sun and the nature of

the sun's 'skin' are all approached from a new angle. Readers with interest in psychology, mythology, Christianity, archeology, geometry,

botany, and even industrial relations, are offered starting points for new lines of enquiry. The disparity between our experience of the sun in everyday life and the corresponding thoughts of modern physics is well presented.

Special attention is paid to the concept of polarity, particularly the polarity between sun and earth. The idea of polar-Euclidean space, as developed by Locher-Ernst, and Adams and Whicher, is treated at length, in chapters headed: 'Space and counter space', 'An excursion into geometry', 'Kernel and Husk', 'The plant between sun and earth', 'Turn-about on the sun's rim', 'Eighty-eight', and 'The sacred loop'.

However, it is surprising that, in a book dedicated to a new physics, no prominence is given to the important contribution made by E Lehrs in *Man or Matter*, in English and German.

The book is addressed to the general public, and some general questions may arise in the mind of

the reader. "No one has written about the sun like this," comments the publisher. So is it the work of an outstandingly gifted individual, drawing also on some contemporary and historical sources; or is the author presenting the world-outlook of some particular 'school'?

What really is the relationship between the new physics and the practice of the Christian religion today? The reader may learn more of Blattman's own position, in this respect, in another book *Radiant Matter* (Floris Books, 1983).

In the world today, Christian commitment may appear in many forms—in conditions of squalor, repression or affluence, against differing backgrounds of personal, historical and geographical circumstances.

"Christians talk about Christ. They think they know him—and yet they have lost sight of his kinship with the sun Conventional theology is, therefore, superficial and must

nevertheless remain so." (*The Sun*, page 10). When Blattman writes in this way, he is expressing a personal point of view. This aspect of Christianity is of great importance to him, but others would not accept the statement without argument: conventional theology serves in, for example, the life of Mother Teresa of Calcutta.

Considerations of this sort should not detract from the value of the book. The new physics is as yet at a very early stage, and one of the aspects meriting special attention is that of distinguishing between the personal and the universal elements, in the process of development—both are important but the distinction needs to be made.

This book is, thus, well worth reading—for a variety of reasons, as I have tried to indicate. "No one has written like this before", but the idea of a wide holistic approach is surely in tune with the Spirit of the Age.

Hedley Gange

The Anthropic Cosmological Principle

by John D. Barrow and Frank J Tipler — Clarendon Press, Oxford. Price £25

Those working at the frontiers of official science are often led, by the nature of the problems studied, to ask deep philosophical questions. This was not the case a century ago when Rudolf Steiner did his basic work in epistemology; the development of twentieth century science has led to a crossing of the threshold into a certain 'spiritual' world. Unfortunately correct anthroposophical concepts are not usually present, and the voice which speaks when the deep questions are answered is often that of Ahriman.

In the book reviewed here the authors, like many other cosmologists, consider the question whether many of the properties of the universe need to be explained by supposing that they are necessary for the existence of intelligent observers. The universe could be different according to this line of thinking, but Man would in such a case not be present to study it! The vastness of the universe according to modern astronomy, many physical properties and coincidences are according to this interpretation all necessary for Man to exist. It is in

such a materialistic way that cosmologists stumble across an idea which should very much interest anthroposophists. The book describes three forms of the anthropic principle:

● **The weak anthropic principle:** "The observed values of all physical and cosmological quantities are not equally probable but they take on values restricted by the requirement that there exist sites where carbon-based life can evolve and by the requirement that the Universe be old enough for it to have already done so." Such a statement is according to official science neither speculative nor controversial. In such a framework one can contemplate the existence of many possible universes, each possessing different properties. Observers like ourselves can then only exist in a small subset of these universes.

● **The strong anthropic principle:** "The Universe must have those properties which allow life to develop within it at some stage in its history".

● **The final anthropic principle:** "Intelligent information-processing must come into existence in the

Universe, and once it comes into existence will never die out".

The last two forms of the anthropic principle are quite speculative in the framework of official science.

The level of different chapters is very different. Some, such as the first chapters, can be understood by readers with a basic scientific education, while certain later chapters require specialized knowledge of relativistic cosmology and quantum mechanics. Most readers of this journal would find parts hard to follow. The book starts after an introduction with a history of arguments for purpose and design in the world. This is followed by a description of more modern work, leading to the discovery of the anthropic principle. The book then discusses various arguments based on the weak anthropic principle, classical cosmology, quantum mechanics, the anthropic principle and biochemistry, and arguments for supposing that Man may be the only intelligent form of life in the Universe. The book becomes highly speculative towards the end, especially in the final chapter where the future of the

Universe is discussed. A future consistent with the final anthropic principle is suggested; the Universe after its present expansion may contract until it is dominated by life at an 'Omega Point'. Indeed the authors suggest that all universes whose existence is logically possible will then be dominated by life!

The kind of reasoning of these highly intelligent authors, and of others who reason in a similar way, can be symbolized by two quotations made in the book. At the beginning of the introduction one can read the famous quotation from the eighth Psalm, "What is Man that Thou are mindful of him?", while on page 295 one can read the quotation from a certain Carl Becker, "What is Man, that the electron is mindful of him?". If we try to see what is at the basis of this reasoning we find that it lies in the concepts of life and intelligence. Life for the authors is a property of a material system, and they give a sufficient condition "That the system is capable of self reproduction in some environment and the system contains information which is preserved by natural selection". Such a system could be a machine, while information and its processing are described by a theory known to computer specialists, with a limit from thermodynamics giving the minimum amount of energy necessary to process a certain amount of information. The authors consider the soul to be a computer programme, which requires a computer in order to work. In a similar way, Thomas Aquinas considered that a soul needed a body to think and feel! The authors even try to

translate German absolute idealism into abstract computer theory.

According to the book the only type of life which can evolve is based on carbon chemistry. Such life if it becomes intelligent can then construct machines which are also intelligent, but life based on carbon chemistry needs certain conditions to develop. A fashionable but questionable interpretation is given to quantum mechanics, that of the 'many worlds' interpretation. According to this, every time a 'measurement' is made all the possibilities of quantum mechanics are realized, and the world (including human beings) splits into disconnected universes. Quantum mechanics then becomes 'determinist' in what is quite a different interpretation from that given by me in my first article in No.6 of this journal, but such a 'determinism' cannot lead to exact predictions in the real world. However the authors of the book use such a picture to suggest that intelligent life only exists in a small subset of all such universes, so the conditions of our universe are those in which intelligent life based on carbon chemistry could develop.

It must be emphasized that the authors are, even from the point of view of official science, wrong when they consider life to be associated with computer programmes. Such a programme does not exist in time but only in the realm of Platonic ideas. There is moreover an article by H. Atlan in *Sciences et Symboles. Les voies de la connaissance* (Albin Michel, Paris 1986, page 317), where this conception of programme is criticized.

According to Atlan, life and certain cybernetic systems require a certain amount of *indeterminacy* in order to operate. This role of indeterminacy appears to be fundamental. It is indeed in such a way that one can understand that the laws of dead matter do not predict everything, but that other things and in particular higher conscious spiritual beings can intervene.

One can perhaps say that the authors of *The Anthropic Cosmological Principle* fall into error, because higher beings are needed to explain the world. Without such beings, it is not easy to see how the world could have been conceived for Man, unless one supposes that Man was created by chance in a small subset of all the universes which exist. If one does not suppose that consciousness is basic, one can easily become a spokesman for Ahriman.

The conception of Rudolf Steiner expounded for instance in *Occult Science* is anthropic (as well as being anthroposophical!), but in quite a different way from that of official cosmologists. It is however necessary for anthroposophists to form links with official science. Modern discoveries are of very great interest from the spiritual point of view, but scientists can go completely wrong if they are not in contact with correct spiritual ideas. If such links are not formed, if anthroposophists withdraw in a sectarian way into a separate culture where they do not encounter other ideas, they will fail!

Michael Friedjung,
Paris

Some Book Notes

Over the past decade a 'new' scientific world-picture has been emerging, and with it new areas of research in physics, cosmology and biology. For most scientists it appears to confirm their materialistic understanding of man and world.

1. Biology

Scarcely a month goes by without some significant discovery in genetics. To take examples at random from the *New Scientist*: genetically engineered micro-organisms, such as a bacterium

to retard the effects of frost on crops; transplanting genes, e.g. 'the gene that lights up fireflies' to produce luminous plants; synthesising 'antigenes' which will bind to a harmful virus and prevent its own genes from being expressed; genetically engineered anti-cancer interferons; pinpointing of human genes believed responsible for diseases, e.g. muscular dystrophy.

In molecular biology generally the pace of factual discovery is almost unbelievable, with new observations

pouring in from such fields as virus research, the cellular basis of memory, brain chemistry, the place of particle physics in the development of organisms.

Following Paul Davies' *God and the New Physics*, though very different in style and outlook, is a recent book *God and a New Biology* by a scientist/theologian, A.R. Peacocke. It represents a school of thought which accepts all or most of the conclusions of biology and physics about the beginning of the physical cosmos

life on earth, and seeks to revise or extend theology accordingly. For instance, it accepts the Big Bang, and that all organic life evolved from the inorganic.

Dr. Peacocke, a physical biochemist and Anglican priest, sets up two interesting hypotheses. Trying, as he did in his earlier *Creation and the World of Science*, to accept Darwinist chance and to reconcile it with theism, he proposes a re-examination of the nature of matter. He also sees the interplay of chance and natural laws as creative in a way which could be the instrument of the Creator's action. To quote:

"Apparently, developing under the control of the regular processes of natural laws, new forms of matter have creatively emerged out of the nuclear particles and atoms of several thousand million years ago, and have now become conscious both of the processes by which they have been brought into existence and of themselves.... it seems that by taking seriously the scientific perspective, we cannot avoid arriving at a view of matter which sees it as manifesting mental, personal and spiritual activities."

These conclusions are from a Christian scientist. The majority of science writers believe that biology now finally excludes any necessity for a Creator God. Richard Dawkins, author of *The Selfish Gene*, in his latest book *The Blind Watchmaker*² uses computer-produced patterns of gene selection ('biomorphs') to try to demonstrate that the evolution of

complex life forms are fully explained by physical laws, and that Paley's famous argument from design is no longer convincing.

Like many such writers, he displays a curious religious fervour in the cause of neo-Darwinism. In a Horizon T.V. programme on his book Dawkins, either unscrupulously or unconsciously, makes the argument easier for himself by setting up an unrepresentative opposition to tilt at: religionists who do not accept the fact of evolution at all, and specifically the so-called scientific Creationists who take Genesis literally in every respect. He concludes that the 'blind watchmaker' of evolution by natural selection does a much better job than a Creator would.

Professor John Maynard Smith's *Problems of Biology*³ gives a succinct account of the whole field and sets out the main ideas and problems clearly and fairly.

The discussion started by Hedley Gange in *Science Forum* No.5 of spiritual scientific work on heredity was timely and needs, I suggest, to be followed up. Spiritual science ought to take account, in its published work, of factual developments which are too easily interpreted materialistically—and not only because of the obvious ethical, social and religious implications of embryo research and genetic engineering.

2. Physics

There has been a spate of books on the philosophical implications of quantum theory since the 1983 Paris experiments apparently established

'nonlocality' or 'nonseparability' in the subatomic world (for a description of this see *Science Forum* No.6, p.2). One of the most stimulating and best written is Nick Herbert's *Quantum Reality*⁴. It gives a fascinating summary, analysis and comparison of eight different 'realities' proposed by physicists in interpretation of quantum mechanics.

The varying conclusions of leading physicists on the nature of matter and the meaning of quantum theory are presented as interviews in two excellent books: *The Ghost in the Atom* (edited by P.C.W. Davis and J.R. Brown, Cambridge University Press 1986) and *Aspects of Matter in Science Today* (translated, edited and published by W.J. Duffin 1985).

Certainly the philosophical problem appears at present insoluble, as far as any general agreement is concerned. As a description of what the human mind seeks as a credible reality, physics has reached an impasse. Will it become possible to show this situation as demanding recognition of the missing element of reality, the spiritual?

Brian Stockwell, January 1987

References:

1. *God and the New Biology*. Arthur Peacocke (J.M. Dent & Sons 1986)
2. *The Blind Watchmaker*. Richard Dawkins (Longman Scientific & Technical 1986)
3. *The Problems of Biology*. John Maynard Smith (Oxford University Press 1986)
4. *Quantum Reality: Beyond the New Physics*. Nick Herbert (Rider 1985)

JOURNALS

Die Drei — Monthly journal of the Anthroposophical Society in Germany

Several articles of scientific interest have appeared during the last year: these include:

July/August 1986. *The work of Elementary Beings in Nature* by Jochen Bockemühl describes how through exercises in a further development of Goethe's sensitive method of observation the activity of each type of elementary being may be recognized. Coloured pictures of flowers, woodlands, hills and waterfalls, in different

seasons, help to identify the characteristic activities of Gnomes, Undines, Sylphs and Fire-Spirits (Salamanders). An associated article by Almut Bockemühl deals with elementary beings in fairy tales and poetry.

July 1986, Special Number. This was occasioned by the *Tschernobyl disaster* of 26 April 1986. Articles by a university professor, a doctor, teachers and a journalist emphasise the seriousness and dangers to mankind of the present situation.

October 1986 and November 1986. Two articles by Klaus Dumke investigate the present state of the *medical knowledge of the human organism*. Modern science, through

instruments, machines and associated theories, provides a vast amount of information. This needs to be balanced by a systematic training in Goethean observation. Meditation provides the key to the transition from the physical to the spiritual. The author systematically develops a scheme which achieves a synthesis of the natural-scientific and spiritual-scientific approaches.

February 1987. A short article, *Finite—infinite* by Arnold Bernhard, shows how, in the realm of number, the crossing of the boundary from the finite to the infinite may be experienced—a first step into the spiritual world. — Hedley Gange

In the following article, translated from *Elemente der Naturwissenschaft* No.44, Dr. Balthasar replies to an article by William Steffen in issue No.38 of the same journal. The latter article is based on research carried out by William Steffen at Botton, as described in Reports issued in 1981 and 1982. A report of this work was published in *Science Forum* No.4.

The reply to William Steffen is given in three sections: 1) Picture-formation, 2) Picture-variability and planetary influences, 3) Uses of the CD method. In Section 1), Balthasar quotes from some of Steffen's experimental descriptions but he does not question any of the details of Steffen's practical investigation of the basic CD process carried out under the described conditions. He does, however, question the conclusion reached. Section 2) is concerned mainly with experiments carried out by Steffen and described in his 1982 Report. As these descriptions are not included in the article in *Science Forum* No.4, we reproduce here the relevant paragraphs, 3.5.1 and 3.5.2, of the Report. These are followed by a 'recap' of Steffen's intentions in initiating his investigations, as given in the closing section (4.5) of his 1982 Report. A comment by William Steffen, recently received, is also included. — Ed

Reply to William Steffen: Investigations of the Experimental and Physico-Chemical Basis of Capillary Dynamolysis

Paul Balthasar

W. Steffen draws the conclusion from his investigations that capillary dynamolysis, as practised by A. Fyfe and M. Engqvist, is to be seen as an inorganic process; this process is determined 'from the outside' in contrast to processes in the living realm, in which an inner, formative principle is at work.

Because of the diversity of possible factors that may affect the picture-forms in CD series from plant materials, Steffen regards it as very difficult to demonstrate the influence of specific planets on the life-processes of plants with this method.

At the end of his report, Steffen discusses, on the one hand, the possible use of the CD method to obtain a not very specific, yet at the same time synthesised, 'total impression' of the metabolic composition of plant saps, and, on the other, the (in his view as yet unanswered) question of the contribution that capillary dynamolysis can make in fundamental botanical research.

This comment on Steffen's work is given under the following three headings:

1. Picture-formation
2. Picture-variability and planetary influences
3. Uses of Capillary Dynamolysis.

1

Picture-formation

W. Steffen (1983) first describes in detail the experimental parameters of the CD method. In a second part, the author deals with the physics of the process of capillary flow, both theoretically and with reference to his own experimental studies. In a third part, Steffen examines the phenomenon of picture-formation in capillary dynamolysis. It may be appropriate to give a short extract from the author's treatise: " A drop of 3% albumin solution is placed on a filter paper, dried and 1% silver nitrate solution is set to rise through the paper. The result shows clearly that a local flow-delay induces a boundary line between two adjacent flow zones, marked by reduced and permanently adsorbed silver. In many cases, the reagent breaks through the upper substance border in dis-

crete places. 1% silver nitrate solution is set to rise in a filter paper which, in the first phase, had been treated with a 20% sucrose solution. Already on rising through this 'sucrose-zone' we observe a strong differentiation of the reagent front. Closer examination shows that during the rising process the reagent front dissolves the sugar, continually depositing it in vertical streaks which are retarded in their flow due to increased viscosity of this solution"

Steffen concludes from these investigations that the CD picture is synthesised as a result of the interaction of the physico-chemical properties of the dried plant sap (or other dried substance) with the reagent.

This conclusion stands in manifest contrast to the interpretation of Fyfe that the picture is related to the formative forces of the plant sap, or to Engqvist's view that the picture-formation cannot be understood as a physical process.

The question now arises as to whether W. Steffen's interpretation can be accepted without further question, as being consistent with

the work of the afore-mentioned authors? *Engqvist* (1977) shows in her work CD pictures of parts of tubers, blossoms, leaves, stems and roots of different plants. In a first step, these pictures point to form-types which it is not difficult to relate to the particular plant organs, i.e. characteristics of a plant organ are translated by the CD process into a form-type of the CD picture.

Fyfe (1967) gives a striking example of similar picture-forms in CD pictures of two different plants (*Helleborus foetidus* and *Iris germanica*). In the subsequent three works (1973, 1978, 1984) *Fyfe* gives further such examples from CD pictures of *Viscum album*, *Helleborus foetidus* and *Iris germanica*: the corresponding CD pictures are shown in the following plates of the three publications: 1973, plates 1, 16, 17, 19, 20 -1978, plates 29, 30, 33 -1984, plates 19, 20, 21. It is apparent from the CD pictures of the three different plant species that the form-types are similar for plants picked at the same time, namely once as an increase in the intensity of the picture-differentiation, next as indentation, then as arching, and finally as a failing, or a marked diminution of picture-differentiation.

From this, both authors place in the foreground the fact that with different plant species, and therefore with plant saps composed of different substances, similar pictures or form-types appear.

The idea of the formative agency as independent of substance can be demonstrated by a further application of the method. *Kolisko* (1959) took as an example the decimal potencies 1-60 of ammonium sulphate, in a vertical filter paper. The height-investigation of this potency range gave characteristically similar curves which cannot be simply attributed to chance. For the reproduction of these curves see *Kolisko* (1959). In these investigations only inanimate substances are involved, namely ammonium sulphate, water and filter paper.

After the 20th potency, no more ammonium sulphate can be active according to the orthodox scientific point of view. Nevertheless the height-experiments gave substance-specific curve 'signatures' which are qualitatively the same as those of the

plant-growth potency experiments: the qualitative equality does not entirely lie in the actual curves but in the ability to reproduce the particular 'signature'. (See statistical certainty in plant-growth potency experiments *Unger* (1971)). In these experiments the formative agency appears, in the afore-mentioned signature, as described above, entirely independent of substance.

The appearance of formative agencies in capillary dynamolysis not bound to substance leads to a problem known to be fundamental in biology. *Mohr* (1976) writes: "We believe in definite properties of macro-molecules, in a universal genetic code, in the central dogma of molecular biology, in the 'One Gene—One Enzyme' relationship, in development as the expression of the differentiation of genes, although we know that the relationship between differentiated enzyme-synthesis and form creation, the cardinal problem of development, remains totally incomprehensible. Certainly we know that, in plants and animals, morphogenesis only proceeds if a strictly time-related synthesis of RNA and protein is assured. But we do not know, not even in principle, how out of the synthesis of information-rich macro-molecules morphogenetic design, in time and space, results."

In this connection one may similarly state for the capillary picture that there exists indeed a relationship between substance and picture-element (as *Steffen* can prove) but, as shown above, a substance-free formative agency appears which cannot be explained out of this relationship.

Thereby a quality is exhibited that cannot be described by an external law, external to this quality itself.

Finally, it is noted that *Steffen* sees the step of drying the plant sap (*Steffen* 1982) as responsible for the loss of the vital formative forces. This conclusion is countered by the methodical reversal of the agents. *Kolisko* (1953) investigated animal and human urine: the diluted urine was set to rise in filter paper that had previously been treated with silver nitrate solution and dried. By this application of the method the step of drying the urine was eliminated and

characteristic picture-formation resulted.

2 Picture Variability and Planetary Influences

Steffen (1983) shows from his experiments (24.7.81. to 7.8.81) that it is possible by standardising the method to eliminate outside influences on the formation of the pictures. Within the above-mentioned period he was able to obtain 180 CD pictures of a particular plant which showed no significant differences in their formation. This statement stands in a certain contradiction to an earlier statement by *Steffen* (1982) relating to the same test series. In the earlier description of the results, *Steffen* draws attention to the fact that differences in the picture-forms did arise, and these in pictures from plants that were picked at the moment of a solar eclipse. On the basis of a further study into the reflection of the circadian rhythm in CD series *Steffen* related these picture-variations, not to the above-mentioned constellation, but to the effect of the day/night rhythm.

It may be added that the two test series are not documented either in the work of 1983 or that of 1982. These two test series, together with factors encountered when trying to standardise the method (which are to be eliminated as discussed above), lead *Steffen* to the statement: "These manifold possible causes for picture-variations in CD series of plant materials would seem to render it difficult to demonstrate, in a convincing way, the influence of particular planets on the life processes of plants."

This serious statement, which really rests only on two test series, contrasts with well-founded and documented investigations, carried out over decades, in which *Fyfe* (1967, 1973, 1978, 1984) repeatedly demonstrated with the help of the capillary picture, the influence of Moon, Mercury, Venus and Uranus on the plant saps of *Mistletoe*, *Helleborus* and *Iris*. *Fyfe* shows quite clearly that the influence of constellations on plants must be investigated during a specific time-

interval. This interval includes several hours before and several hours after the moment of the constellation. During this period the plants have to be picked at regular half-hourly or hourly intervals and tested with the capillary picture.

The foregoing procedure was not followed by *Steffen* (1982) in his investigation, where picking took place only at the moment of constellation and four hours afterwards.

Since the investigation of *Steffen* (1982) in regard to planetary influences on plants is neither documented nor appropriately conducted, not to mention the absence of any repetition, the above-mentioned statement of *Steffen's* cannot be ascribed any scientific value.

3

Uses of Capillary Dynamolysis

Since modern methods of chemical analysis exist which provide accurate and specific assays of plant constituents, there is little sense in trying to replace those with the capillary dynamic method.

With regard to the use of the method in basic botanical research, it

is to be noted that this has already been done for decades. *Fyfe* (1969) was able to make specific statements, on the basis of CD pictures, concerning the life-processes and seasonal transformations of mistletoe during the course of the year. These insights, gained through capillary dynamolysis, were later confirmed by *Zeller* (1976) through morphological investigations.

To conclude these comments I wish to point to the fact that L. Kolisko took up the method of capillary dynamolysis on the suggestion of Rudolf Steiner, who accompanied and advised her efforts in this field (*Kolisko* 1934).

References

- Engqvist, M.** (1977): Die Steigbildmethode. Frankfurt a.M.
Fyfe, A. (1967): Die Signatur des Mondes im Pflanzenreich. Stuttgart
Fyfe, A. (1969): Die Mistel im Jahreslauf. Elemente d. N. 10, S.22.
Fyfe, A. (1973): Die Signatur des Merkurs im Pflanzenreich. Stuttgart.
Fyfe, A. (1978): Die Signatur der Venus im Pflanzenreich. Stuttgart.
Fyfe, A. (1984): Die Signatur des Uranus im Pflanzenreich. Stuttgart.
Kolisko, L. (1934): Mitteilungen des

Biologischen Instituts am Goetheanum, Nr.1. Stuttgart.

Kolisko, L. (1953): Die Landwirtschaft der Zukunft. Schaffhausen.

Kolisko, L. (1959): Physiologischer und physikalischer Nachweis der Wirksamkeit kleinster Entitäten. Stuttgart.

Mohr, H. (1976): Zur Zielsetzung der Entwicklungsbiologie. Biologie in unserer Zeit 6, 161-168, aus Matile.

P. (1978): Neujahrsblatt der Naturforschenden Gesellschaft in Zurich

Steffen, (1982): The Physico-chemical Basis of Capillary Dynamolysis. Botton Science Laboratory, Report 2.

Steffen, (1983): Untersuchungen zu den experimentellen und physikalisch-chemischen Grundlagen der Steigbildmethode. Elemente d.N.38.S.36.

Unger, G. (1971) et al.: Potenzierte Heilmittel. Stuttgart.

Zeller, O. (1976): Die Jahresrhythmik der Laubholzmistel album ssp. album. Beiträge zu einer Erweiterung der Heilkunst nach geisteswissenschaftlichen Erkenntnissen. Nr.6.

21, rue de Mamer
L-8081 Bertrange

(This article is published by kind permission of the Editor of *Elemente der Naturwissenschaft*.)

Extracts from W. Steffen's Report No.2 (Botton, 1982)

3.5.

Two Test Series with Stinging Nettle

To end this outline of our investigation, we report here on two series which were performed on comparative plant materials over a stretch of time.

3.5.1.

A New Moon Series

On July 31 1981, 03.52h GMT a New Moon constellation occurred which was simultaneously a partial Solar Eclipse. With plants from an exceedingly uniform Stinging Nettle colony we carried out daily CD tests from July 24 until August 7. Since circumstances did not allow us to make daily pickings at 03.52h, we picked regularly at 08.00 GMT. On July 31

we picked additionally at 03.52h, the time of the constellation. Only the four leaves of the two well-specified nodes on each plant were used. Leaf material was collected from duplicate plants and separate extracts were then produced, each set in five test papers for phase 1. Three tests in each set were run with AgNO_3 0.7%, the other two with H_2O as reagent. The tests with AgNO_3 as reagent were finally fixed with $\text{K}_2\text{Cr}_2\text{O}_7$, the whole series of 180 papers arranged in an appropriate way, photographed and assessed. In all instances there was a very good coincidence between the duplicate series of each picking time. Variations in rising height and form tendency in the tests of the 15 days' daily pickings at 08.00h were small and showed no significant

changes around July 31. There was, however, a remarkable difference between the pickings at 08.00h and those at 03.52h on July 31. The tests from the early morning pickings had a markedly increased rising height and a significantly more linear, upright tendency. Was this change due to the constellation or due to general variations in the diurnal cycle? We tried to answer this question by investigating variations over a 36 hour period using the same experimental pattern, with material from the same colony.

3.5.2

A series on the Diurnal Rhythm

We picked four-hourly (duplicate plants), starting on September 3 1981, 06.00h local time (BST) ending

on September 4, 18.00h. The test series, comprising 100 papers, clearly showed a 24-hour rhythm with regard to rising height and differentiation. The pictures at 02.00h and 06.00h showed clearly the greatest rising height, straightest linear forms, and least differentiation. In the consecutive tests performed at 10.00h, 14.00h and 18.00h, on both days, there was an increasing tendency towards lower rising heights, and more stunted and differentiated forms. This tendency receded again in the tests made at 22.00h. The test series seemed to suggest that the observed differences in the New Moon series (see 3.5.1) between the pictures of 03.52h and 08.00h was mainly due to variations connected with the daily cycle, and that this might closely correlate with the diurnal photosynthetic cycle.

4.5.

The Situation with Capillary Dynamolysis

Let us now consider the concrete situation of Capillary Dynamolysis and a sap under investigation. The archetype of the particular plant is incarnate in its activity, differentiation, development, metabolism, form etc., each aspect being perceptible for the appropriate 'organ of perception'. The plant sap, being an integral part of the holistically organised plant organism, will have a relationship to all parts of the plant and their development, carrying the imprint of the archetype as well as the Earth's body: it certainly is a 'rich entity'.

The filter paper in the CD test has been manufactured by extracting the cellulose fibres from plant material,

isolating them as far as possible from the remnants of still incarnate plant being In phase I of the CD test the liquid sap is set to rise up through the filter paper by capillarity which it does according to the inherent intention of the manufacturer.....

Now we let the filter paper dry. The water evaporates from the sap. By this we have almost completely immobilised all inner activity of the plant sap that would reflect a manifestation of life processes. Even the mineralising breaking down processes are largely inhibited. With most plant saps this drying, immobilising process is largely irreversible, the sap cannot be to any great degree redissolved by water.....

The phenomena occurring in the course of the second phase thus appear to be closely related to general inorganic properties of filter paper, metabolites and reagent. The dried plant sap only seems to specify the process in so far as it consists of a particular composition of metabolites; these of course being the result of life processes incarnate up to the time the sap was dried and immobilised.

The appearance of spatial forms is certainly not a quality restricted to the manifestation of life processes. But spatial forms of living organisms always have a strong inner necessity and the organism often has a capacity to restore and recreate its forms. Forms encountered in mineralised and 'man-made' objects lack this inner re-creative capacity and reflect the character of the inorganic processes involved as well as the human intentions, the designing impulse. Forms of such objects are 'outer

necessities' and change readily under different 'outer' impacts.....

Life processes are highly differentiated, qualitatively as well as by intensity, and it would seem that changes in the balance of metabolites—which in CD lead to inhibitions and stunted forms for instance—can be the expression of a great variety of processes each with its own intensity. An attempt to correlate inhibited tendencies or any other form element in CD to a general 'lack of formative strength' seems fundamentally difficult.

We are convinced that the situation is very different in cases where, for example a plant elixir or a homeopathic medicine is applied: here the substance with all its 'richness' is implanted into a living organism which can be receptive to this. The response of the organism to the remedy will not be the adjustment of an isolated symptom, but rather a modification and perhaps an improvement of the balance of life processes.

One of the vital questions to be settled with regard to Capillary Dynamolysis seems to be the following one: Have we really designed the experimental situation in CD adequate to that facet of a plant sap which we want to know something about? We are not suggesting that rising tendency or form elements are being 'created' or 'produced' by the physical properties of the substances involved. But we ask ourselves whether we have not designed an experimental set-up which only allows the interplay of the inorganic processes between the dried metabolites, the filter paper and the reagent to manifest, losing just about all the original 'richness' of the fresh plant sap on the way.

Comment by William Steffen — April 1987

Since the publication of my studies on Capillary Dynamolysis a considerable amount of discussion has focused on the questions raised in these investigations. For three years a small working group of many of those actively working with or on CD has made a beginning in assessing our understanding as well as the current practical use and value of this method. The working group was convened by

Dr. H. Knijpenga of the Research Laboratory at the Goetheanum, Dornach and I had the chance of taking part in its efforts.

This initiative arose in the hope that it may be possible to overcome the unfruitful controversy in which this 'picture-forming' method has been involved for some time. Some individuals in the anthroposophical movement consider this method as a

great breakthrough into a new science and have devoted their lives to the task of its development; others, just as dedicated to the development of a science rooted in the Goetheanistic approach, would not touch this field, convinced that it is a waste of time and an aberration of anthroposophical science.

This is not the place to give a detailed account of the work of the

above-mentioned working group. A colloquium was held in December 1986 at Dornach, where some of the insights and questions were shared with a wider group of individuals who are themselves involved in anthroposophical scientific and medical work. The main contributions are currently being collated and should be published in Summer 1987 in the form of a special issue of the *Elemente der Naturwissenschaft* (in German). Our deliberations have led us to realise that only through very careful handling and clarification of concepts such as organic or inorganic processes, form, substance etc. can we hope to make any progress in our understanding. Similarly we have to continually be aware of the direction and quality of our questions guiding our thinking at a particular moment. Furthermore, particularly through the work of H.J. Strüh, R. Mander and V. Zavesky some further light has been shed on interesting connections of basic features in CD pictures with classes of substances which are of interest in the pharmaceutical context. These correlations point to the fact that the pictures can only be seen together with the living origin of the material tested and with a Goetheanistic appreciation of the phenomena of capillary flow.

★ ★ ★

Concerning the above critical review of my earlier studies by Dr. Balthasar I feel it would not be appropriate to reply point by point to his views, since this runs the risk of cementing positions. As indicated, the whole issue is (also for me!) in flow. Yet, in my own defence, I would like to take up one of his points. In Section 2 of his review entitled 'Picture variability and planetary influences' he suggests plain unscientific conduct of my investigations and interpretations. The two CD series he focusses on are described in the 1983 publication with the following words:

"In order to test the practical handling of the defined procedure in the context of larger systematic comparative studies over extended periods of time we conducted two fairly extensive CD series: In the first series possible picture-variations were investigated over a time span which included the occurrence of a new moon/sun eclipse constellation (31.7.1981). Daily duplicate pickings (of *Urtica dioica* leaves) at identical times between 24.7. and 7.8.1981 did not show any significant picture variations around the time of the constellation. The series comprised 36 plant saps resulting in 180 CD pictures. In the second series we picked, in duplicate form, leaves of *Urtica dioica* from the same colony as in the previous series in a four-hourly rhythm over a 36-hour time span. In this case we found clear picture-variations which, as far as was possible to assess within this time span, seemed to repeat themselves in a 24-hour rhythm. This series comprised 20 plant saps resulting in 100 pictures."

From this extract it will be evident that the primary intention of these series was the testing of my by then carefully defined standard procedure in a real life comparative study. In this 1983 article there follows not even a comment on the results with regard to the constellation question, and this passage is clearly part of the section entitled 'Experimental Parameters'. If carefully read, Balthasar's alleged 'contradiction' with the 1982 report does not arise since the text only reports on the 'daily pickings at identical times (which was 08.00h GMT) between 24.7. and 7.8.81 which did indeed not show any significant variations throughout the whole time span. The one picking at 03.52 GMT on 31.7.1981, which was the time of the constellation, showed a significantly different picture. This phenomenon gave additional encouragement to perform the already planned round-the-clock investigation, which

was designed with two questions in mind: the practicability of the standardised method in a different real life situation and the possible reflection, in the CD test, of the diurnal photosynthetic cycle of this particular plant.

In the 1982 report which Balthasar mentions, the wording is admittedly somewhat more focussing on the constellation aspect which was implicit in the first series. Yet the interpretation rendered in Section 3.5.2, which the editors of this journal have included above, is sufficiently cautious: "The test series seemed to suggest that the observed differences in the 'New Moon series' (see 3.5.1) between the pictures of 03.52h and 08.00h was mainly due to variations connected with the daily cycle, and that this might closely correlate with the diurnal photosynthetic cycle." Nowhere do I suggest that these series would throw any doubt on the results of constellation work done by other authors.

Yet Balthasar now goes on stating: "These two test series together with factors encountered in trying to standardise the method (which are to be eliminated as discussed above), lead Steffen to the statement: 'These manifold possible causes for picture-variations in CD series of plant materials, would seem to render it difficult to demonstrate, in a convincing way, the influence of particular planets on the life processes of plants.'" This serious statement, which really rests only on two test series, contrasts with well founded and documented investigations,"

This, I am afraid, is a rather gross, unfounded allegation. My conclusion just quoted (which indeed I still hold) derived entirely from my experience with the method and its delicate experimental parameters summarised in the paragraph immediately preceding the quoted extract (El.d.Natw., 38, p.48). It has nothing to do with this single CD series performed around the time of one constellation.

Further Notes on Holistic Science

Hedley Gange

This article amplifies the brief notes on holistic science given in *Science Forum* No.6, p.24.

Two basic features of the present approach are: first, an extremely wide initial field of interest and second, an intended progression towards precise and systematic methods. The term 'holistic' is encountered increasingly in various aspects of modern life: the Spirit of the Age is expressing itself, it seems, in the urge towards a wide and unified approach. Some current trends and proposals are vague, but there is also much in contemporary life and thought that is of actual or potential value, in the holistic sense.

● **Modern Science.** Some aspects of modern science may be readily assimilated into holistic science, as mentioned in the earlier article. A great deal more may be incorporated if certain changes of emphasis are made or 'mental reservations' applied. Much of modern science and technology, in for example the fields of transport, telecommunications and domestic facilities, has a vitality and human significance because it is part of everyday life. In some important respects, it qualifies for inclusion in the sphere of holistic science. Seen against a wider philosophical and cultural background, both its sphere of authority and its limitations can be assessed and its place within the broad holistic world view determined.

Other fields may be similarly approached. In, for instance, the study of the physical and chemical properties of matter, subatomic concepts and their associated mathematical models and theories can be accepted, in the first place, as working hypotheses—though not as descriptions of reality.

● **Human Qualities.** The pursuit of natural science is based upon such human qualities as open-mindedness,

i.e. a willingness to examine differing explanations and expositions on their merits, and moral integrity within the sphere of interest of science. In holistic science, both the range of interests and the diversity of human qualities involved are wider. These qualities are being developed, in a general way, in the course of contemporary co-operative or mutually interacting activities—in agriculture, ecology, education and other spheres. In a more systematic, though necessarily more limited way they are being developed by some physicists, biologists, economists, doctors and others who see the possibility of extending the existing scientific method to include human values.

The inclusion of aesthetic values in the general approach introduces the possibility of individual differences of judgement and taste. The holistic view seeks to embrace both personal and universal elements. It is necessary first to recognize those areas in which individually varying factors form part of the field of study.

● **Gifted Individuals.** Spiritual leaders and others may have special gifts, connected with, for example, spiritual vision, healing or extra-sensory perception. It is of interest to note any common threads or descriptions of similar experiences by different investigators. The principle that individual, moral development is a prerequisite to spiritual knowledge is becoming increasingly recognized. The importance of traditional spiritual values in the sphere of science and technology was stressed, twenty years ago, by E.F. Schumacher: today the influence of such individuals as Sir George Trevelyan is considerable. A fundamental concept is that of the development of 'the whole man'.

● **The work of Rudolf Steiner (1861–1925).** The work of Rudolf Steiner is, of course, known with:n

the holistic movement. An indication of the impression made by this work is given in the book *The Loom of Creation* (Neville Spearman, 1975). The authors, two scientists, D. Milner and E. Smart, working at Birmingham University, decided to investigate the relationships between the findings of modern science and ancient wisdom, to study "the purpose and the forces that weave the pattern of existence". After extensive research, they came to the conclusion: "The only writings that we have found that give first-hand accounts of the nature of existence as perceived by expanded awareness, and at the same time penetrate to the deepest levels, and are expressed in language comprehensible to Western man, are those of Rudolf Steiner." (page 59). The authors take their start from the standpoint of modern science and then seek to widen the method, the range of cognitional faculties involved and the subjects accessible to investigation.

This wider influence of Rudolf Steiner today appears in various forms, some of a general nature, others more specific or specialized. Among the latter, the following may be mentioned: contributions to current activities in the sphere of comprehensive (or complementary) medicine; the principles of Steiner education; and Flowform research.

● **The Language of Holistic Science.** The language of natural science has special characteristics, associated particularly with logic and mathematics. The pursuit of science is, however, dependent also upon wider considerations—upon the general social and intellectual basis provided by contemporary culture. The fact that the language of science is more restricted than the language of culture generally may give rise to tensions. In some sections of society today,

science is viewed with a degree of apprehension, as being possibly inimical to some of the finer aspects of human development. For this reason, the term 'holistic science' may bring unintended associations, and it may be well here to point out that the term is intended to embrace *wisdom* and to be relevant to *all* aspects of modern culture, including, for example, poetry, music and the visual arts. The language of holistic science should arise, organically, from contemporary life and culture.

The present approach is developed, especially, against the background of modern science and technology. Many different 'access paths' are however possible, in view of the wide range of interests, activities and disciplines involved.

● **A Plan for the Future.** The future development of holistic science will evidently involve a complex interweaving of different streams and interests. This suggests the possibility of the formulation of an outline plan to assist in this development. The production of such a plan is beyond the scope of the present article but some probable features of the plan may perhaps be mentioned.

The aims of the plan would be: to give a general indication of possible future achievement (in regard to both methods and fields of study); to allow individual workers to see how their contributions may relate to the whole; to encourage intercommunication and co-operation; and promote an integrated and cohesive approach. The main lines of current research would be indicated: common links and the interaction of social, ethical and more specialized factors would be emphasized.

Special attention would be given to the progressive and ordered evolution of methods and concepts. An essential feature would be the facility for continuous updating, the plan itself being an integral part of the organic, developmental process.

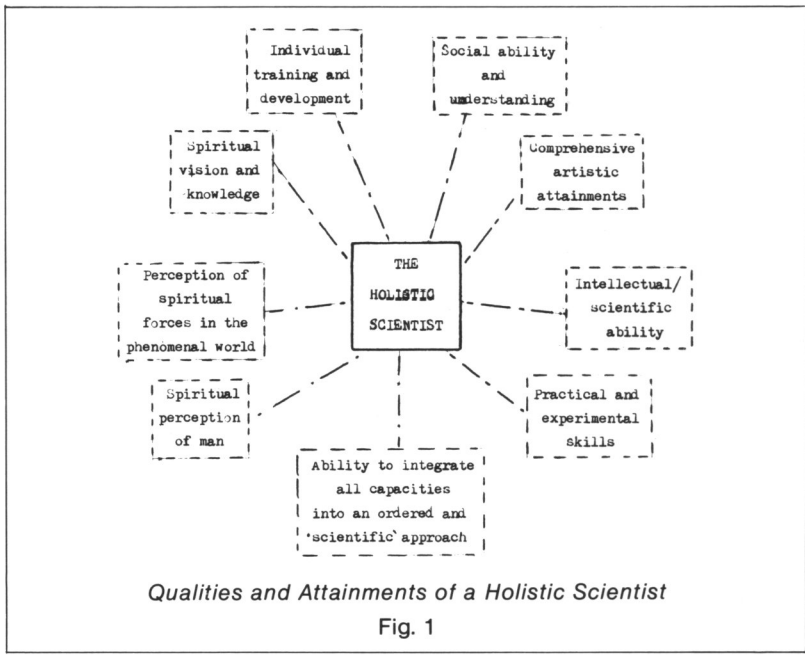
The plan should reflect the great variety of ways in which the first steps towards the holistic approach may be taken.

● **The Exponent of Holistic Science.** The investigator in the field of holistic science is required to develop his or her faculties more widely than the natural scientist. The initial steps on this path may be taken from the standpoint of the artist, the sociologist or the theologian—as well as that of the biologist or the physicist. Each is required to develop his or her

cognitional faculties beyond that normally expected.

The competent exponent of holistic science combines, ideally, all these faculties and paths of training, and many others, in one comprehensive approach. This is indicated, in a schematic way, in Fig. 1, which includes references to some of the main factors. Individual development is fundamental, and progress for most people is likely to be slow. Nevertheless, it is important that the goal towards which efforts are being directed should be clearly stated.

In view of the wide range of skills, talents and qualities involved, co-operation in groups and communities will be particularly appropriate—within the wider, universal context.



Subscription Form

to: **Science Forum**, c/o Rudolf Steiner Press, Mail Order Service, 38 Museum Street, London WC1A 1LP

Please send me copies of **SCIENCE FORUM No.8**

Please tick this box if you want to become a regular subscriber

Name:

Address:

Post Code: