Soil and Health Library

Part Two.

SMALLEST ENTITIES IN AGRICULTURE.

Chapter I.
INTRODUCTION

It may seem strange to speak about "smallest entities" in agriculture, but it is absolutely necessary that farmers and gardeners learn to understand this important phenomenon.

The problem of minutest quantities, or better "smallest entities", was studied from 1920 in the Biological Institute at the Goetheanum (Stuttgart) and later on in the Biological Institute at Bray, Berks. The attempt to find a remedy for "Foot-and-Mouth Disease" led us to the question of "smallest entities". What is the right concentration of the specific remedy to be injected? Rudolf Steiner suggested that the effect of different dilutions on germinating plants should be studied. From 1920 until to-day we have been studying this interesting subject. One might think that this is a *medical* problem rather than an agricultural one. Of course it is a medical problem in that we are looking for a certain remedy, but it becomes an agricultural problem as well if we study how the growth of plants is affected by substances which are diluted, or rather potentized.

What does "potentize" mean? Exactly what the word itself expresses. In potentizing a substance, we increase its effectiveness. We make the substance more potent. The strange thing about potentizing is, that we have to reduce the amount of the substance which we want to make more potent. In everyday life we are accustomed to think: if we want to make something more effective, we have to take a bigger quantity. For instance, if we want to make coffee sweeter, we take a second teaspoonful of sugar (provided we have it!). In homoeopathy we are told just the opposite thing. If we want a stronger action from a certain remedy, we have to potentize it, that means dilute it in water or alcohol, again and again, in a rhythmical way.

That is the first and most important thing we have to learn: to discriminate between matter and force. Matter can act in two different ways: as matter, or as the specific force behind the matter. In everyday life we ask only for matter, for quantity, and we do not even stop to think, that there is something like a force which is active in every kind of matter. Sugar is not only sweet – that is **one** quality of sugar we discover by means of our rather coarse sense of taste. Besides being sweet, sugar has many other qualities we cannot taste, but our organism realizes them; only we are not aware of everything that sugar does in our organism.

Now we must raise another important question: What do we want in reality? The substance itself, or the inner quality of the substance?

For instance, a farmer may be convinced that his soil needs lime. How does he solve the problem? Usually he digs a large amount of lime into the soil. Again and again he will dig in lime.

Let us study the influence of "smallest entities" of lime on the germination of wheat. We put a certain number of seeds in a control dish with water. Then we dissolve one gram of calcium hydroxide in ten parts of water and shake the mixture for some minutes; then we have the *first* potency or a *dilution of* 1: 10.

We take 1 part of the first potency; mix it with 9 parts of water; shake for the same time, and we have the second potency, or a dilution of 1: 100. We may continue this process of diluting as long as we like. Usually we make our experiments up to the 60th potency. Having finished all the potencies, we insert the carefully selected seeds, and, a few days later we compare the results.

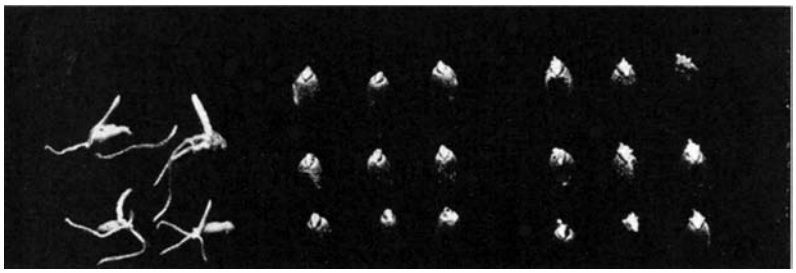

Fig. 40 Water control 1st potency (1: 10) 2nd potency (1: 100)

The seeds inserted in the first potency of lime scarcely start to germinate. The effect of lime in such a high concentration is thus proved to be unfavourable. The seeds in the second potency begin to sprout, whereas those in the water control are much more advanced in growth.

Fig. 41 3rd potency (1:1,000) 4th potency (1:10,000) 5th potency (1:100,000)

The 3rd potency is more advanced than the 2nd, the 4th is of about the same value as the water control, the 5th already surpasses the water control and has definitely better developed roots.

Fig. 42 *6th potency* (1:1,000,000) *7th potency* (1:10,000,000) 8*th potency* (1:100,000,000)

The 6th potency is more advanced than the 6th, and the 7th and 8th potencies show still more increase in growth. That means, if we observe these few potencies, that a dilution of 1: 100, 000,

000 of lime produces a much better growth than a lower potency. The lime works much more powerfully if we use a minute quantity. Whenever we have to introduce lime into a soil we need not dig in a large quantity of the solid matter, but spray a certain potency carefully on the surface of the soil.

It is an easy, and a very economical way of helping the soil which is lacking in lime.

Chapter II.
Experiments with Wheat grown in the Open

In this experiment the grains were soaked in the usual series of potencies, in one case in sulphate of iron, in another in chloride of quicksilver. After soaking for some hours, the grains were dried and then planted out in the garden, each separate potency in its own little plot, and were allowed to grow to maturity without further treatment. The effects of the earlier experiments with germinating grains could now be observed in the full-grown plants. Some plants showed a luxurious growth of rich green stalk followed later by full heavy ears of corn, while others turned yellow quite early and showed but meagre growth.

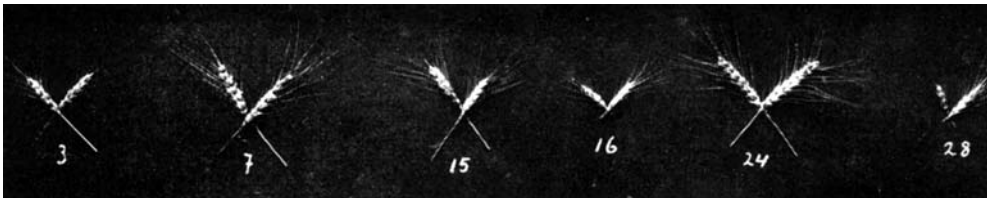

Fig. 43
shows some examples from the group soaked in potencies of quicksilver chloride. The first pair of ears (3rd potency) shows practically the same results as the normal non-treated grains which were used as control. The 7th potency shows enlarged growth, the 15th is smaller than the water control and the 16th potency is quite definitely a minimum. The 24th potency reaches maximum growth, the 28th potency is a second minimum, while the 30th potency again shows a growth beyond the normal.

- L. Kolisko, *Physiologischer und physikalischer Nachweis der Wirksamkeit kleinster Entitäten,* 1923.
- L. Kolisko, *Physiologischer Nachweis der Wirksamkeit kleinster Entitäten bei 7 Metallen,* 1926.
- L. Kolisko, *Physiologischer Nachweis der Wirksamkeit kleinster Entitäten,* 1932.
- L. Kolisko, *Mitteilungen des Biologischen Institutes am Goetheanum,* No. 1, 1934; No. 2, 1934; No. 3, 1935; No, 4, 1935.

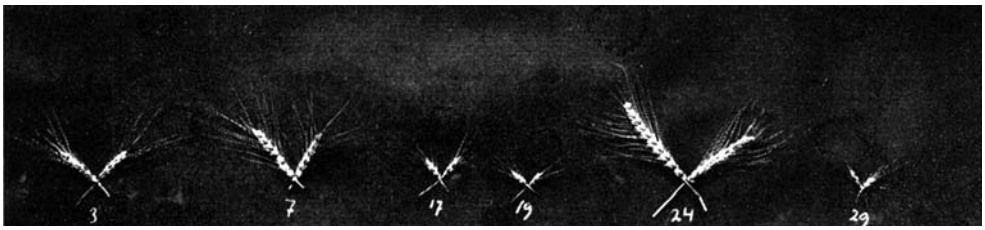

Fig. 44
demonstrates the result of the experiment carried out with iron sulphate. The 3rd potency is of about the same growth as the water control plants, the 7th potency shows increased growth; the 17th and 19th potencies are the first minima in this series; the 24th potency reaches maximum growth; the 29th potency represents a second minimum. The 30th potency is again beyond normal growth.

If we study the influence of smallest entities on plant growth, we find a very interesting law. According to the substance we are using, we can find that the 1st, 2nd and sometimes even the 3rd potencies are unfavourable for plant growth; then with increasing dilutions (we can also say with decreasing concentration) the process of germination starts. At a certain dilution it reaches the same point as the water control; then it surpasses the water control, even to a considerable extent. Many substances reach a first maximum at the 7th potency (1 part of the substance diluted in 10,000,000 parts of water). Then again we find that the plants decrease in growth gradually. We nearly always get very tiny and sometimes even distorted plants, between the 11th and 18th potencies (according to the substance; silver, for instance, has an early minimum between the 11th and 13th potency; gold salts show rather a late minimum about the 18th potency). After the first minimum is reached, the plants show increasing growth again. That means we are using much smaller entities, or much higher dilutions, whichever expression you like; so **matter can be entirely neglected. The chemical tests come to an end, but the living plant organism shows us quite clearly there is something influencing its growth favourably or unfavourably.**

The plants reach a maximum, they are much bigger than the water control plants, at about the 21st to 24th potencies. After having reached the maximum, the plants again decrease gradually. We reach another minimum at about the 28th potency and so on. A rhythmical process, producing maxima and minima reveals itself through these experiments. Thousands of experiments have been carried out since 1920, with many varieties of plants, and about 300 different mineral salts and plant juices. The result is beyond any doubt.

Chapter III.
Experiment in the Open with Hyacinthus Candicans

To make quite clear what has been said, we add a short report on an experiment with hyacinthus candicans. We selected a large number of first-class healthy bulbs. Some of the bulbs were allowed to germinate in water for control purposes. The other bulbs (five for each potency) were inserted in potencies of silver nitrate (from the 1st to the 30th potencies). On Supplement XI (at the end of this book) we reproduce one series. The 1st potency destroyed the bulb completely, so no germination could take place. The 2nd potency produced only a tiny sprout; the 3rd reached nearly the growth of the water control plant, only no flowering stem could be developed. The 4th surpassed the control pot considerably; then the growth gradually diminished again. The 12th potency represented a first maximum, the 14th the first minimum: a tiny, deformed plant with no flowering stem. The 15th and 16th potencies were also unable to produce flowers. The 21st potency represented the maximum for the whole series of thirty potencies. The second minimum appeared at the 28th potency.

Sometimes we get a clear rhythm in steps of seven, as we see in this experiment. The first minimum 14th potency; maximum, 21st; second minimum, 28th potency.

Fig. 45

Water 7th **14**th **21**st **28**th potencies.

The exact figures are:	1st minimum	Height	40 cm.
	2nd ,,		28 cm.
	Maximum		140 cm.
	Water control		105 cm.

We have also to notice, that there is not only a difference in measurement, there is also a difference in time. While the 12th and 21st potencies were in full bloom, the water control had not yet fully developed the flowering stem. At the time when the 1st potency reached 140 cm., the water control plant only reached about 80 cm. The 21st potency having faded long ago, the water control plant gained its maximum length with 105 cm.

Fig. 46 Graph showing the measurement for the above series of 30 potencies.

There are many possibilities for studying this extremely interesting subject in the open, or in the laboratory, or in the glasshouse. The laboratory experiments last only a fortnight. For the details we refer to our various publications* since 1923. For each potency we use about 30 grains. The grains are allowed to germinate on glass dishes in the respective potencies; then they are placed in larger pots filled with garden soil which has never had any artificial fertilizers. Every other day they are watered with the potencies, and after a fortnight, the small wheat plants are carefully taken out of the pots, the roots cleaned from the adherent soil, and the measurements of each plant are taken. In a fortnight two leaves have developed. The length of each leaf and the roots are measured, then we reckon out the average length for each potency. One experiment means 2,000 plants and the water controls; four measurements are to be taken on each plant (first leaf, second leaf, internodes, roots), that is 8, 000 measurements. With a well-trained assistant it is possible to do the whole procedure in about three hours. (I am very grateful in this connection to Mrs. L. Deman who helped me for many years, taking down the measurements with great speed and

exactness. Later on Miss Beck succeeded her in this responsible task.) Then, of course, the addition and division of the figures for each potency, and the making of the graph has to follow.

Of course you need time and much patience for exact experiments. But this is not the task of a farmer or a gardener, it is the task of the scientist and his helpers; later on the farmer and gardener may benefit from their work.

Chapter IV.
THE EFFECT OF "SMALLEST ENTITIES"

studied on the following salts:

(1) Potassium Nitrate
(2) Sodium Nitrate
(3) Ammonium Sulphate
(4) Sodium Phosphate
(5) Potassium Phosphate
(6) Superphosphate
(7) Potassium Sulphate
(8) Potash Permanganate

It is interesting to study the effects produced by some of the salts which science of to-day thinks necessary for plant growth:

Potassium Nitrate (KNO_3)

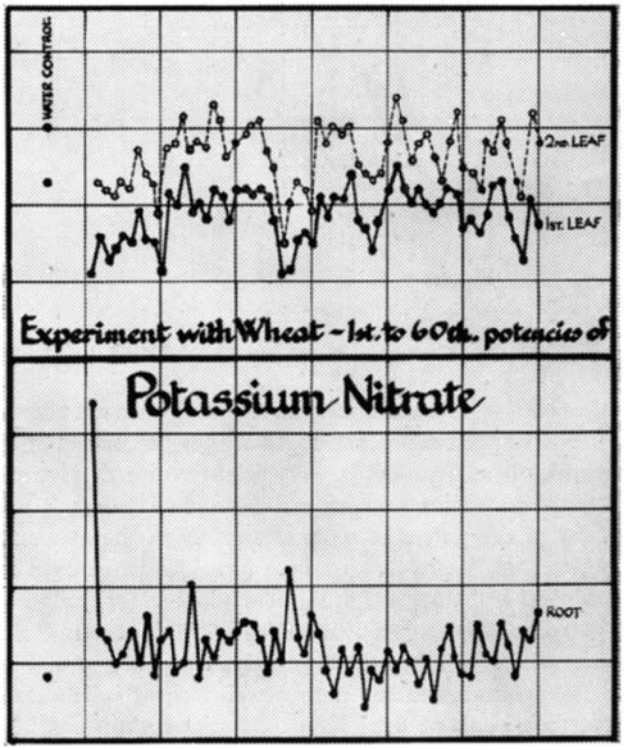

Fig. 47 Graph of an experiment with wheat from Ist-60th potencies

The first plant indicates the average growth of the water control (30 plants). The 1st potency (a dilution of 1: 10) developed only one tiny leaf and very short roots. That means that the concentration 1: 10 nearly killed the germinating power of the seeds. The 2nd potency is better, but

the result still smaller than the water control plant. We see that the graph slowly climbs upwards, reaches the first minimum at the 10th potency; the 13th potency is better than the water control; the 17th is the first maximum. Then again the growth decreases and increases, and reaches a minimum at the 26th and 27th potency; and again growth increases and decreases. The third minimum is reached at the 38th potency; the second maximum is reached at the 41st; the fourth minimum at the 58th potency.

The roots produce the first minimum at the 14th and the second at the 27th potencies; the maximum is at the 37th potency.

Examining the whole graph, we are justified in saying that there are two distinctive phases to be seen. The first one continues until the second minimum; then one complete rhythm comes to an end, which repeats itself in an harmonious way.

Such a graphic picture of the influence of smallest entities on plant growth can be considered the reflection of the inner dynamic of the material which has undergone the process of potentizing.

Potentizing is a rhythmical process. The solid matter has been dissolved either in water or alcohol in a certain proportion (1: 10, or 1: 100). The process of dissolving can be either by stirring, if we have a large quantity; or by shaking, if we have a small quantity. It is important to know the right length of time for these procedures. For the details I again refer to my various publications on this subject. Then we must continue to keep the same proportion for diluting, and the same interval for shaking.

There is another way of making potencies, if we use substances which cannot be dissolved in a liquid. In this case we make a fine powder of the substance to be potentized, and rub the powder together with a more or less neutral substance (for instance, lactic sugar) in the same proportion, 1: 10. Then we again take a tenth of the first potency, and rub it into nine parts of lactic sugar for about two hours that makes the 2nd potency, and so on.

Nitrate of potassium, or nitrate of potash, or saltpetre, or simply nitre, is very much used as a fertilizer. It occurs in considerable quantities in the soil of certain hot countries. It is artificially manufactured from refuse animal and vegetable matter, which is mixed with calcareous soil. In this way calcium nitrate is formed. When this substance is treated with potassium carbonate it yields potassium nitrate = nitre.

Everybody knows that nitre has many uses. One we have already mentioned, is as a fertilizer. Therefore, we have studied this substance from the standpoint of agriculture. But nitre is also used in metallurgical and chemical processes, and last, but not least, in the manufacture of explosives.

We proceed to the study of **Sodium Nitrate** ($NaN0_3$):

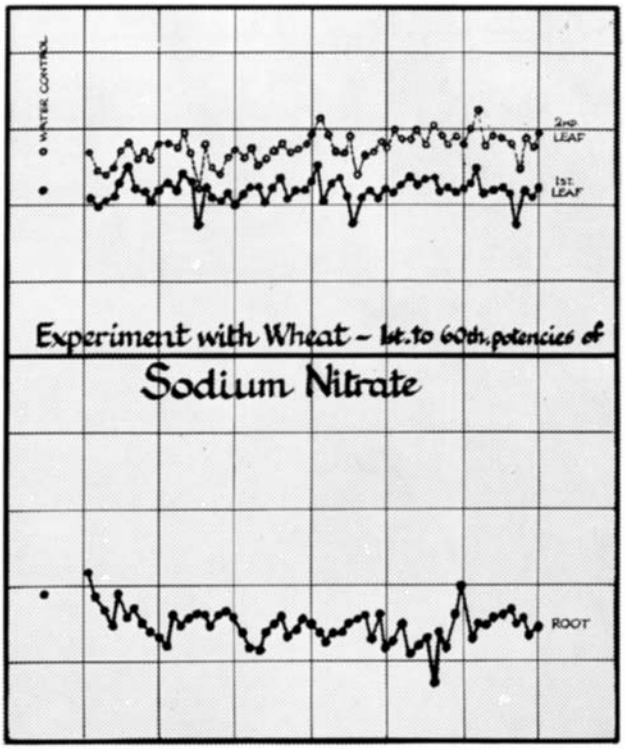

Fig. 48 Graph of an experiment with wheat, 1st-60th potencies

This graph differs very much from the previous experiment with potassium nitrate, although we may even find a certain similarity. For instance, the movement of the first six potencies resembles, to a great extent, the graph of potassium nitrate. But the minimum is reached only at the 15th potency; then the plants gradually increase in growth and reach the first maximum at the 31st potency. The second minimum we find at the 36th, the third minimum at the 57th potency. The second maximum is reached at the 52nd potency.

The roots gradually increase in growth, until the 46th potency, and produce only one minimum at the 50th potency.

But the whole dynamic of sodium nitrate differs immensely from the dynamic of potassium nitrate.

Sodium nitrate dissolves very easily in water. This quality makes it understandable that we find this mineral in workable quantities only in regions with very low rainfall. The most important deposits of sodium nitrate are found in the Atacama Desert (Northern Chile); that explains why it is also called Chile saltpetre. This salt is used in great quantities as a fertilizer, for the production of nitric acid and other chemical purposes.

Ammonium Sulphate $(NH_4)_2SO_4$

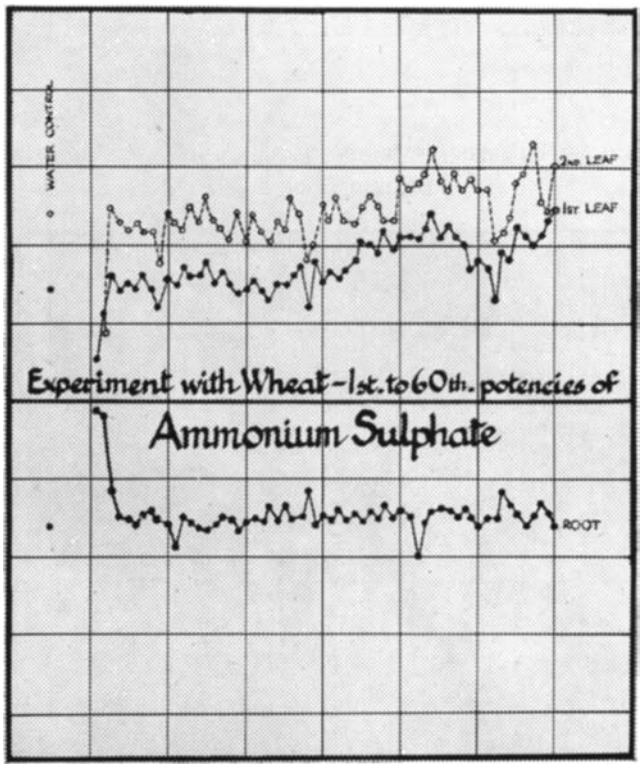

Fig. 49 Graph of an experiment with wheat, 1st-60th potencies

Ammonium sulphate produces a strange phenomenon right at the beginning. The first two potencies are rather tiny plants. Therefore, it is astonishing to see the jump to the 3rd potency. It already surpasses the water control plant; and then the plants decrease again. One feels, that this sudden jump does not mean a favourable influence for the plant. It is, more or less, a big shock inflicted on the plant organism; therefore immediately afterwards the plants are thrown back again to their due limits. The first minimum is reached as early as the 9th potency, the second at the 28th.

Then the second phase of the graph begins, reaches the maximum at the 44th potency, the third minimum at the 52nd and again a maximum at the 57th potency. But, it seems, after the third minimum, the second phase has come to an end, and a third one begins; the end we cannot see, because it must happen at about the 75th or 80th potency.

The roots reach maxima at the 11th and 42nd potencies, minima at the 28th and 53rd potencies.

Again, the dynamic of this substance is different from that of the previous ones.

Ammonium sulphate occurs in nature as yellowish-grey mealy crusts in the neighbourhood of volcanoes. It is also found in guano deposits, together with other ammonium sulphates.

It is extensively used as a fertilizer.

Sodium Phosphate

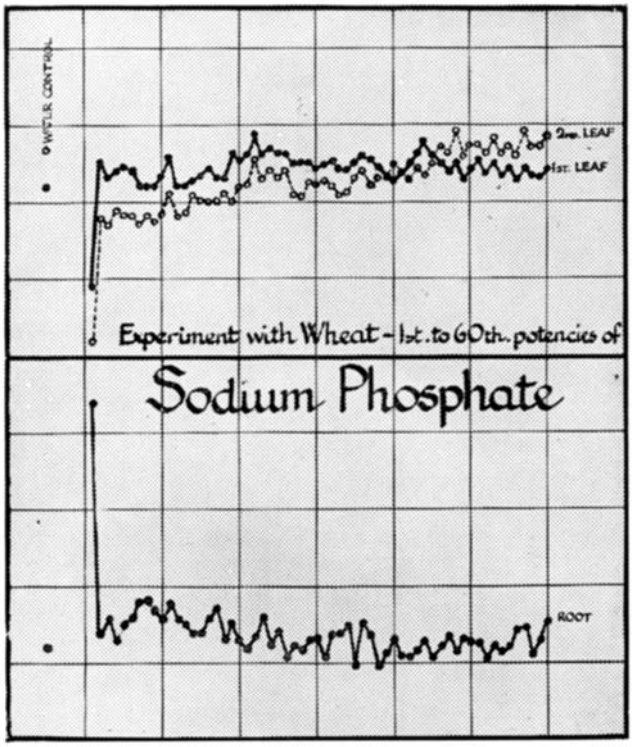

Fig. 50 Graph of an experiment with wheat, 1st-60th potencies

The first glance reveals immediately a graph representing three periods of a rhythmical process. The first period reaches as far as the 22nd potency; the second until about the 46th potency; then the third period (which is incomplete) begins.

Another interesting detail is that the two leaves cross at the 40th potency. The second leaf becomes longer than the first one. This fact has a special meaning.

Studying the growth of wheat plants in daylight, in intensified light with the help of electricity, and in a dark room (these experiments are fully explained in Chapter VI), we get certain characteristic differences. If the plants grow under normal conditions, they develop two leaves in a fortnight. During summer time the second leaf is longer than the first one; and during winter time, the opposite phenomenon is seen. If we increase the light influence, plants always produce a short first leaf, and a much longer second leaf. The internode is shortened. If the plants grow in a dark room, the first leaf is much longer than the second one, and the internode is also lengthened.

Knowing these interesting facts about light and darkness, we must say that sodium phosphate produces in the higher potencies the same phenomenon as increased light.

We proceed to another phosphate, to find out, if this "light" phenomenon is again produced in the growth of wheat plants.

Potassium Phosphate:

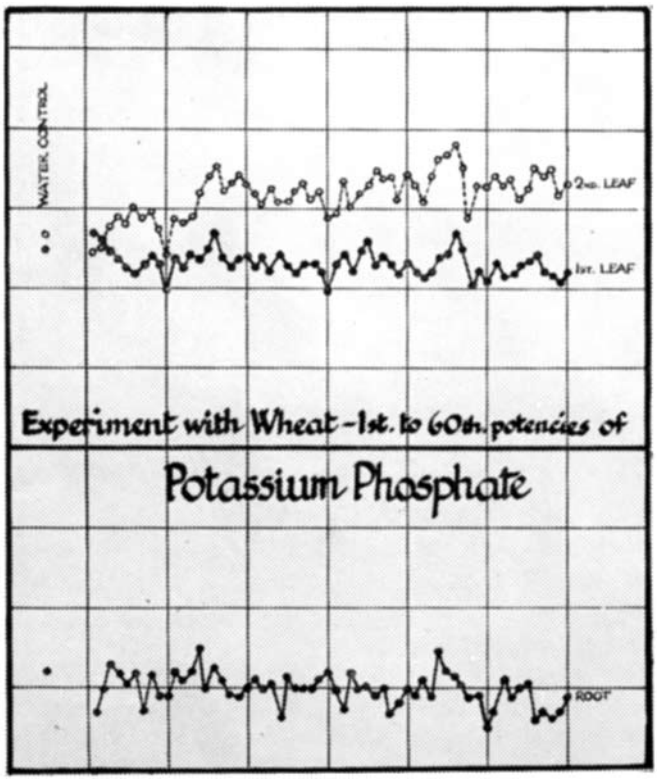

Fig. 51 Graph of an experiment with wheat, 1st-60th potencies

The water control plant shows only a small difference between the first and second leaf. That means, during the time of the experiment there was not much sunshine.

The 1st potency is represented by a plant with a large first leaf; that means it has an effect similar to "darkness." The 2nd potency still shows that phenomenon, but not so strongly; the 3rd potency produces a longer second leaf, that is: "light" phenomenon, and for the rest of the graph we see quite clearly a considerable "light" influence in comparison with the water control plants. (Of course, this experiment has been carried out in a glasshouse, so that every pot had the same amount of external sunlight. There was also no difference of warmth or humidity in the air or soil.)

The first minimum is reached at the 10th, the second at the 30th, the third at the 48th potency. The first maximum at the 16th, the second at the 46th potency.

The roots produce the minima at the 14th and the 44th potencies, the maxima at the 24th and 50th potencies.

Superphosphate

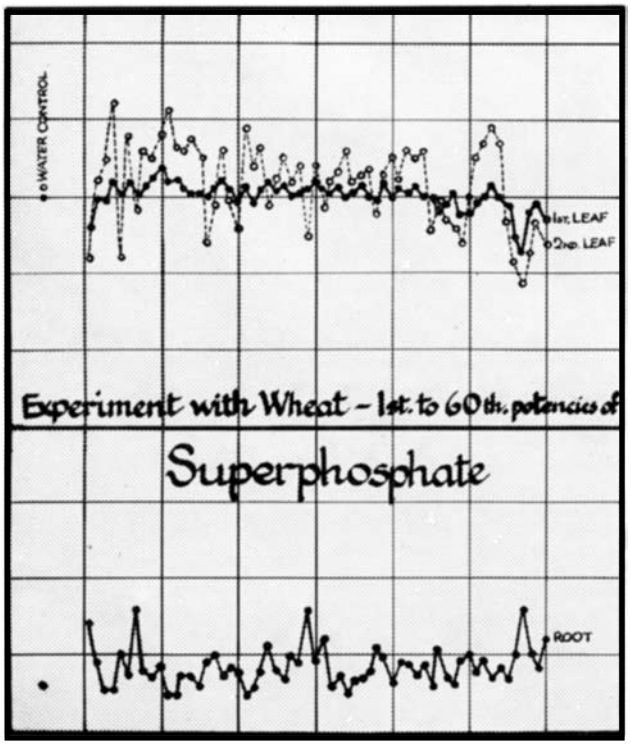

Fig. 52 Graph of an experiment with wheat, 1st-60th potencies

This is the most commonly used phosphatic fertilizer. The water control plant indicates only a small light influence, the first and second leaves are very close together. The 2nd potency already produces a plant which is even better than the water control. Of course, there is only a small difference. The 3rd is much better, and we see quite distinctly that the second leaf is longer than the first one, that shows light influence. The 4th potency is much too big and is immediately followed by a very tiny plant. This is a clear picture of a shock. It is as though you push a pendulum very hard, so that it swings violently to the right; then it happens quite of itself, that it has to swing as violently to the left. Therefore we could never suggest using, for instance, such a low potency of superphosphate. The effect on the plant is not favourable. The 11th potency is the first maximum, the 16th the first minimum, the 29th the second minimum, the 49th the third minimum and the 57th the fourth. The 53rd potency is the second maximum.

The roots show the first minimum at the 7th, the second at the 29th, and the third at the 57th potency.

It is quite interesting to see that nearly all potencies produced a "light" effect, only the minima indicate a "darkness" effect.

Potassium Sulphate

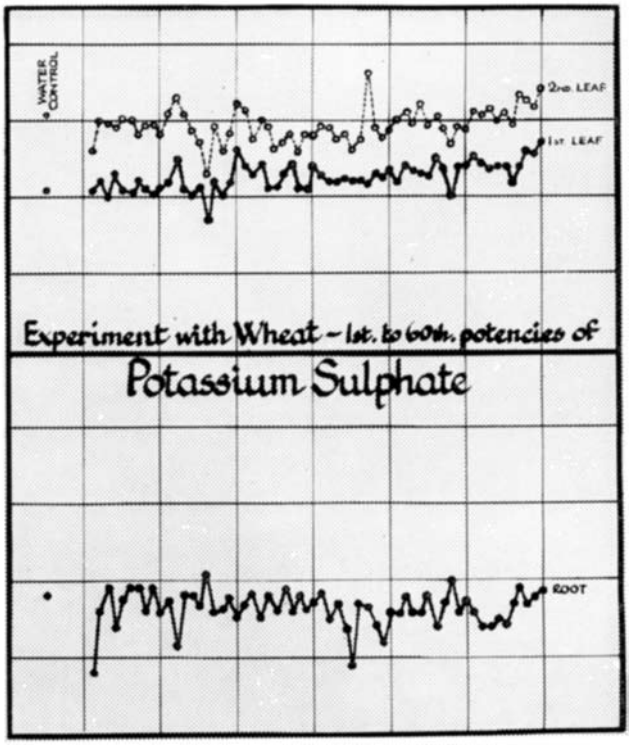

Fig. 53 Graph of an experiment with wheat, 1st-60th potencies

The first maximum occurs at the 12th potency, the second at the 37th potency. The first minimum at the 16th, the second at the 48th potency.

Maxima of the roots occur at the 12th and 35th potencies

Minima ,, ,, ,, 16th and 48th potencies

Potash Permanganate

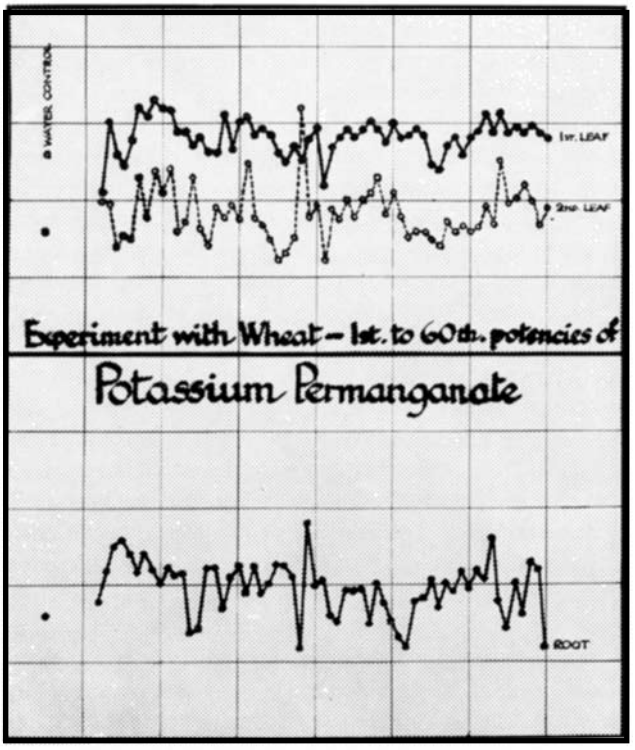

Fig. 54 Graph of an experiment with wheat, 1st-60th potencies

Another interesting type is represented in this graph. Here we may even discriminate between four periods. The first ends at about the 16th, the second at about the 31st, the third at the 46th, and then the last one seems not quite complete The whole graph shows the phenomenon of "darkness". The first leaf is much bigger than the second, with only one exception. The 28th potency represents the maximum, which overthrows the whole character of the graph. It jumps out quite suddenly and interrupts the steady course of the four periods mentioned before. The 28th potency shows a "light" effect.

The roots have the following maxima: 14th, 28th, 42nd, 60th; and two minima: the 29th and 53rd potency.

These few examples must be sufficient to demonstrate that each substance has hidden in itself a specific dynamic. We can study this dynamic with the help of such experiments. Minute quantities have the power to influence the living organism of plants. We cannot prove the existence of such " small entities " with chemical tests. There is no matter to act and react in a test-tube. Matter has been dissolved to such an extent that we cannot trace an atom of it. That is the strange phenomenon – **we trespass from the field of matter into the sphere of pure forces.** For twenty years we have studied this subject carefully. We tried again and again, invented new experiments,

searched for every possible mistake. The experiments have been carried out in the laboratory and in the open. We controlled the influence of light, of darkness, of electricity, of magnetism, of warmth, of humidity, and the influence of the different seasons. We tried different mixtures of soil: pure leaf mould; pure sand; the plants were raised in earthenware pots, in glass dishes, on filter-paper, on cotton-wool, in test-tubes, one single seed in one test-tube (swimming on the surface of the liquid, with a small ring of glass wool to prevent it submerging). There were thirty test-tubes for each potency, hundreds of water control test-tubes. Still the result was the same: with increasing dilution at first increasing growth; then decreasing; minimum growth far below the water control plants; and then again increasing growth, with the maximum far above the water control plants, and again decreasing…

The living organism of the plant is influenced by a 50th potency even more strongly, than by a high concentration of matter. As chemists we must say: "there is nothing; it is only water". But the plant tells us: "there is something more powerful than matter". The free force is acting, is radiating through the liquid. We do not really like to say "radiating". It is true that radiating forces stream through the potencies, but nowadays, to use the expression "radiating force", means something more or less material to nearly everybody. It is something which emanates from a certain point, and goes like a straight line to another point somewhere in space. But a radiating force is everywhere, it is not a physical thing, it cannot be touched, it cannot be seen, it cannot be measured, it cannot be put on the scales; it can only be experienced in its effects. But it can be studied as exactly as any other branch of natural science.

We want to point out, that although examples with different fertilizers are given, we do not suggest using these fertilizers in potencies instead of in large quantities. The reason for this will be given in other chapters of this book. We only wish to give exact scientific proofs, showing that the growth of plants can be influenced by minute quantities – but we must know which substances the different plants really need.

Chapter V.
THE SILICA PROCESS IN NATURE.

Silica plays an important part in the earth crust. In reality it is the element which we find most frequently. According to the newest investigations, about 25.74 % of our earth consists of silica. That is an enormous amount if we compare it, for instance, with the amount of calcium (stated to be only 3.4 %) or sodium, 2.6 %; potassium, 2.4: %; magnesium, 2 %. Silica unites with oxygen and forms SiO_2. We find it in beautifully formed crystals, like rock crystals, for example. If we take into consideration that nearly all the silica is bound to oxygen, then we get more than half the earth crust consisting of silicon dioxide 55.3 %. But that is not all; silicon dioxide is also to be found in other minerals, and metal oxides, so that the full amount of silica substance in our earth crust has been estimated at about 97 %.*

As mentioned before, we either find silica in beautiful crystals: rock crystal, or the so-called smoky quartz (a brown variety), or amethyst (a mauve variety); or we find it amorphous like onyx, cat's eye, or jasper. Here again we may differentiate between silicates containing water like the beautiful semi-precious stones, the opal, or without water like the agate.

The crystallized silica is extremely hard and cannot be dissolved in water. Every farmer or gardener knows, that if he has a sandy soil, the water just runs through.

Quite another thing happens if the soil contains much clay. Clay **absorbs** water, silica cannot absorb it. It is also very difficult to melt silica. It is possible to make a kind of glass out of silica, which has a great resistance to any change of temperature. Such a silica glass may be heated until it is glowing red; and if it is dipped in cold water or even liquid air, it will not crack. This means, that silica does not expand much if heated. It is also not easily attacked by acids. Therefore we can understand that silica glass is used for chemical purposes. Ultra-violet rays may pass silica glass.

Nearly all natural mineral waters contain a small amount of silica. In sea water, rivers, springs, ground water, in the hydrosphere, everywhere we find some silica,

We enter the sphere of life, and find silica again in the plant kingdom. The diatoms, silica-algae deposit millions of tons of silica at the bottom of the sea. We find it in the peripheric parts of nearly all the Gramineae, and there is one plant which contains an enormous amount of silica substance: Equisetum arvense (horsetail).

In the animal kingdom the Radiolariae have a silica skeleton, then there are the silica-sponges; and fish scales, butterfly wings, feathers of birds, animal hair, all contain silica.

The human organism has silica in the supporting tissues, cartilages, bones, intestines, lungs, skin, hair, nails, teeth and eyes.

The Russian scientist, Prof. Dr. W. Vernadsky, who has written a remarkable book about **Geochemistry**, is convinced, that no living organism can exist without silica. Still it is not yet quite clear what part this element plays. It is partly used for the formation of the skeleton, of the tissues and cells in plants and animals. It is concentrated in the membranes, in the connective tissues and the epithelium. But we also find it in the protoplasm and sometimes we even find the hypothesis that the colloidal nature of protoplasm may be due to the presence of colloidal silicic acid. This would mean, that organisms contain silica only for the sake of its physical properties. There are no proofs whatsoever for this assertion.

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* Prof. Dr. W. Vemadsky, *Geochemie,* Leipzig, 1930. *Akademische Verlagsgesellsch.*

It is quite interesting to study the circulation of the silicates in nature, and an enormous amount of work has been done in this domain by scientists all over the world. Still the question remains: What is **the real task of silica?**

Rudolf Steiner mentioned in his agricultural lectures in June 1924, that silica has the quality of absorbing light beneath the surface of the soil and makes it possible for the light to act there. **There is light above, but there is also light within the soil, and this light can act, and can be used by the plants: that is the task of silica.**

Quite the opposite effect is produced by Humus. **Humus excludes the activity of light.**

It may seem strange, but why should it not be possible for silica to act as a kind of catalyst for light beneath the surface of the soil? At least we can try to find out if this is true.

Chapter VI.
Influence of Light and Darkness on Plant Growth

Before entering into the details of these experiments I want to say a few words about plant growth in general. Of course, it is familiar to us all, but sometimes things which are very familiar to us, can be studied from various aspects.

We take the seed and put it into the soil. Then we water the soil and germination takes place. Two elements must work together: soil and water. The seed begins to sprout, tiny roots and a tiny leaf – but they grow in opposite directions. We say the roots grow geocentrically, the leaves heliocentrically. That means the roots have the tendency to grow towards the centre of the earth, the leaves towards the centre of the sun. The roots grow in the direction of the force of gravitation, the leaves against gravitation.

When the shoot pushes through the soil it comes into contact with two other elements: Light and Air. Sunlight and warmth, the whole atmosphere, partake now in the development of the plant. Between these two polarities: Light and Darkness, influence of the Earth and influence of the Sun, or still better, between earthly and cosmic forces, plants grow. It would be insufficient to limit ourselves to the sun forces, because we are able to prove that the moon also has a great influence upon plant growth. We have dealt with the moon influence in Part I, Chapter II. We shall never be able to understand plant life if we cannot understand the interplay of earthly and cosmic forces.

We can study the chemical composition of the soil; or try to understand plants with the help of a microscope; or at last burn the plants and analyse the ashes. But with all these methods we shall never find life. Such methods are only apt for studying the **inorganic**, but a plant is a living being, it grows, and can reproduce another living plant. **We need a science of life.**

We must admire natural science and be grateful for all the investigations carried out in the last centuries. But this natural science presents the plant to us, as a very complicated chemical product. The plant as a living organism is not explained.

How do light and darkness influence plant growth? This problem has been studied very carefully by many scientists. Some scientists* are of the opinion that plants grow more quickly in darkness, because the protoplasmic synthesis is quicker in light. Also the formation of albumen

* H. Euler, Braunschweig 1909, " Grundlagen und Ergebnisse der Pflanzenchemie." 100

is more vigorous in light. Others say: "It is not so simple that we may say, light hinders plant growth. At first, light produces increased growth, and later retards it." There are also scientists who believe that electric light of sufficient power influences plant growth in a way similar to sunlight.

We studied the influence of light and darkness to begin with under quite normal conditions. Nature enabled us to do this. During the course of a year there is increasing and decreasing sunlight. We started our experiments in January, and finished them at the end of December. Each week we inserted thirty grains of wheat in glass dishes filled with garden soil. . The soil used for our experiments was carefully prepared, and we never used any artificial fertilizer. Five different varieties of wheat were studied every week, and for each variety we used two pots each containing thirty grains. After a fortnight the plants were taken out of the soil, the roots carefully cleaned from the adherent soil, and then we measured the length of the first leaf, the second leaf, the internodes and length of the roots of each plant. Fifty-two experiments were carried out in one year; each experiment lasted a fortnight. These were laboratory experiments. The glass dishes were placed on a large table near a window facing south. Of course, during the whole year we did not change the conditions in the room. The only change was due to the light which streamed through the window, according to the changing seasons.

A corresponding series of experiments was carried out in a dark room. We quote the average figures for the different months of the year, 1932:

(a) Experiment in daylight

Month	*1st leaf cm.*	*2nd leaf cm.*	*Internodes cm.*	*Roots cm.*
January	13.0	10.7	5.2	15.4
February	6.9	4.2	2.3	12.4
March	8.8	10.1	4.0	18.6
April	11.3	15.5	4.8	20.9
May	13.4	18.8	5.4	14.2
June	12.6	20.1	4.3	18.0
July	17.0	25.0	5.5	15.6
August	15.0	23.0	5.8	23.0
September	13.8	21.8	4.8	17.4
October	9.9	15.5	4.1	19.2
November	8.0	9.0	3.0	16.5
December	7.3	4.5	2.3	14.0

We find that in January, February, December, the first leaf is longer than the second; and for the rest of the year the second leaf is longer than the first one. Maximum growth is in July, minimum in February, as regards the leaves. Maximum growth in August, and minimum in February as regards the roots.

(a) Experiment in the Dark Room

Month	*1st leaf cm.*	*2nd leaf cm.*	*Internodes cm.*	*Roots cm.*
January	5.5	0	0	9.8
February	20.1	0	0	17.5
March	16.1	0	0	18.1
April	18.1	0	0	17.5
May	28.0	0	0	17.0
June	21.6	14.5	9.0	16.6
July	35.0	28.7	17.3	17.8
August	31.0	28.0	14.1	15.5
September	29.3	19.8	13.7	14.7
October	23.0	13.0	8.1	16.9
November	8.5	0	0	11.0
December	0.7	0	0	3.7

During the first five months, only the first leaf develops; the next five months produce the second leaf; still it is smaller than the first one; and the last two months of the year again produce only the first leaf.

We notice that the length of the internodes is considerably increased in comparison with the experiment in daylight. Maximum growth is in July as regards the leaf, in March as regards the roots.

The plants growing in a dark room show, of course, the well-known phenomenon that the leaves are yellow instead of being green. The internodes which usually are a shade lighter green in daylight than the leaves, are perfectly white, like the roots, in the dark room.

We can take the average growth of the whole year for these experiments, and get the following figures:

	1st leaf cm.	*2nd leaf cm.*	*Internodes cm.*	*Roots cm.*
Daylight	11.4	14.9	4.3	17.1
Darkroom	19.7	8.7	5.3	14.7

We can say that light makes a longer second leaf, darkness makes a longer first leaf, and reduces the length of the roots. This statement we can make in comparing an experiment carried out in daylight with an experiment carried out in a dark room. But we can make the same statement by studying the growth during a whole year in daylight, because the same phenomenon is to be seen during the " dark " months of the year. In January, February and December, even in daylight the first leaf is longer than the second..

What happens if we increase the influence of light?

We made many experiments using electric light. For instance, plants were allowed to grow during the day under the normal influence of the sunlight, and then during night had an additional influence of electric light.

Other series had only electric light from morning until evening, instead of sunlight.

Another series had electric light incessantly (day and night) **for a fortnight.**

We used an "Osram Nitra" bulb, 1,000 watt, and had to make special arrangements to avoid an increased effect of heat. The plants grew very quickly and in a fortnight developed three leaves instead of two. Many plants even produced four leaves.

The average figures for an experiment consisting of thirty control dishes with thirty plants in each (900 plants) follow:

1st leaf cm.	*2nd leaf* cm.	*3rd leaf* cm.	*1st Internode* cm.	*2nd Internode* cm.	*Roots* cm.
14.0	25.0	32.0	4.5	3.3	27.0

Returning to the experiment carried out in daylight during a whole year, we had the average measurement of 11.4 cm., for the first leaf, and 14.9 cm. for the second leaf. Increased light increased the phenomenon already mentioned: viz that the second leaf increases considerably in growth under increased influence of light.

We may even say, that the difference between the first and second leaf indicates the amount of light influence. The larger the difference between these two leaves the greater the amount of light which has influenced the plants. With daylight we have a difference of 3.5 cm., and with the electric light the difference is 11.0 cm.

Chapter VII.
The Influence of Silica and Humus on Plant Growth

Having studied for years the influence of light and darkness on wheat plants, we then undertook experiments in connection with the influence of silica on the one hand, and humus on the other. Now we may well ask: What is humus? There is no chemical formula for humus. We can define what silica is, but we cannot give a scientific definition for humus. Still it is a most important factor in every soil and determines its fertility. It means the amount of **life** in the soil: organic matter from plants or animal bodies in disintegration, rich in oxygen, nitrogen and carbon. A soil rich in humus, means a soil in which the **process of life** is in full swing. A black soil is nearly always rich in humus. The best test is to take a handful of soil and to smell it – and then you smell the "life", if you have a sensitive nose. You will recognize by its texture that it is well worked through by earth worms, it has a certain amount of moisture – but above all it smells of life. A really good farmer does not need a chemical analysis or a microscopic test; he feels and smells the soil, and can tell you how much fertility it contains. But we will deal with this question in detail in later chapters.

In order to study the influence of silica and humus, we made the following experiments. Assuming that silica has the capacity to activate the light in the soil, then we may expect that an experiment with wheat germinating in a soil which contains a certain amount of silica, will show us the phenomenon of "light" according to our previous studies. That means we shall find an

intensified growth of the second leaf in comparison with a control experiment in the same soil without silica.

Description of the Experiment

Fifty glass dishes having about the same proportion as an ordinary earthenware flower-pot were filled with the same garden soil that had been used for all our previous experiments; thirty grains of wheat were inserted in each of these fifty pots. These seeds had to be selected carefully in regard to their germinating capacity.

Fifty glass dishes were filled with the same soil, mixed with a small amount of pure silica sand. The sand had been pulverized so finely that it felt like flour. Thirty grains of wheat were inserted in these pots.

Light: "Osram Nitra" bulb, 1,000 watt.

Duration: Continually day and night for twelve days.

The first glass dishes received the direct rays of the electric light; then we erected above the glass dishes a channel of strawboard blackened inside and outside. The channel had a length of ten metres. Imagine the light streaming into this channel with decreasing intensity. At the end of the channel there was almost complete darkness. We hoped to show by this arrangement, how plants grow in a greater or less intensity of light, from what was almost darkness up to a degree of light equal to 1,860 candlepower. We had two rows of glass dishes each containing fifty pots in a space of ten metres covered by this black channel.

The glass dishes, which we filled with the mixture of soil and silica, were dipped at first in distilled water so that some water adhered to the glass; then we put a thin film of silica sand on the sides of them (about 22 gm.). After having inserted the seeds, they were covered with the soil (1 cm.) and again some silica sand was sprinkled on the top.

Small differences in temperature could not be completely avoided. We tested the temperature with thermometers inserted in each pot.

Observations during the Experiment

All the plants germinated quickly and continued to grow satisfactorily. The first pots which were under the direct influence of the light, produced plants of a very intense green colour; the greater the distance from the light, the more the vivid green lost its intensity. Then gradually the green changed to yellow. We had succeeded in changing over from an experiment in intensified light to an experiment in darkness. The first plants were standing perfectly upright; further on, the plants tried to reach the light, as though running towards it; the light Was attracting them very strongly. In the final portion of the channel the plants were again standing upright, as in a dark room, only without being able to produce chlorophyll.

The experiment was concluded at the end of twelve days, and we took the measurements. Whenever we used electric light we had to end the experiment as early as the twelfth day, because the plants grow much more quickly than in ordinary daylight; but they lack inner strength. The leaves are thin and weak, and break easily. Of course it is abnormal to let the plant grow under the influence of electricity instead of the sun, and this abnormality must show itself somehow in their whole structure.

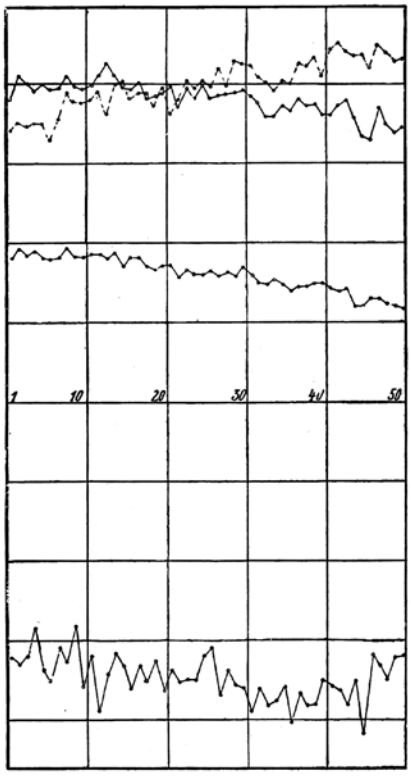


Fig. 55 Experiment with decreasing light-intensity and with garden soil

No. 1 represents the pot standing in darkness, and 50 the pot immediately under the electric light. We see that the internode is very short, owing to the light; and it increases with decreasing light. The greater the darkness, the greater the distance of the internode from the seed.

The first leaf is larger in the darkness until the 14th pot inclusive. The second leaf is larger than the first one from the 26th until the 50th pot.

Between there is a sphere where light and darkness battle with each other; up and down and up and down. The roots grow longer, the greater the intensity of light.

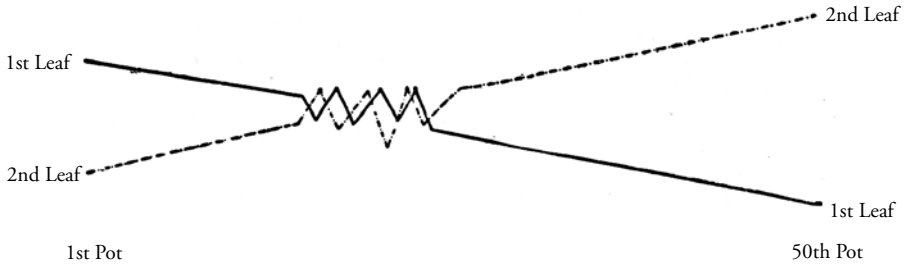


Fig. 56 Simplified diagram of the above graph

Description of the Experiment with Silica

The graph represented in Fig. 52 shows also three different parts. The first part showing distinctly the effect of darkness between the 1st and 20th pot; the second part is rather short, between the 20th and 26th pot; and the third part between the 27th and 50th pot shows distinctly the influence of the light.

The internode slowly increases towards the darkness.

The growth of the roots is not so well defined as in the previous experiment.

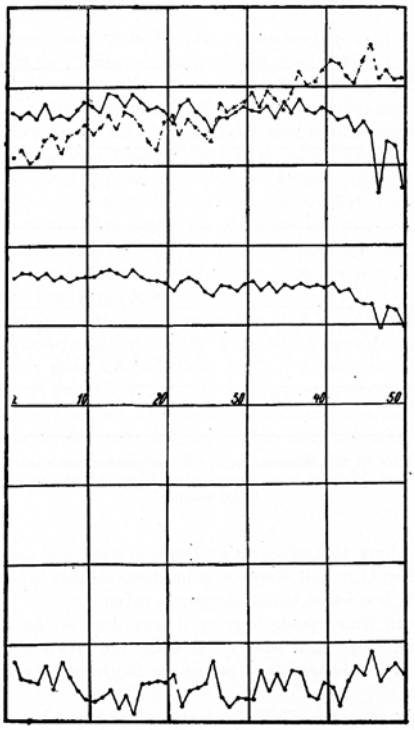


Fig. 57 . Experiment with decreasing intensity of light soil mixed with silica

Can we find in these two graphs that the silica has produced a "light" phenomenon? We have to look at the following points:

Light increases growth of the second leaf;

It decreases the internodes;

It increases the growth of roots.

If we examine these two graphs carefully, we find that the effect of darkness is less distinct in the experiment with silica, because the maximum growth of the first leaf is reached with 21.2 cm. in garden soil, whereas the silica mixture reaches only 19.5 cm. as the maximum effect of darkness.

As regards the internode we see at the first glance, that the silica mixture does not make the internode rise as far in the darkness as garden soil does. That means again: the effect of darkness is lessened in a soil mixed with silica. The maximum reached for the internode in garden soil is 9.7 cm., the minimum is 6.0 cm.; the silica mixture has a maximum at 8.5 cm. and the minimum at 4.7 cm.

Comparing the two graphs as regards the roots, we see quite distinctly, that the garden soil produces shorter roots with increasing darkness; whereas the silica mixture remains nearly at the same level from the end to beginning. That means the darkness did not effect the root growth in the silica mixture as it did in a soil without silica.

We find phenomena of light which we can attribute in these experiments only to the presence of silica.

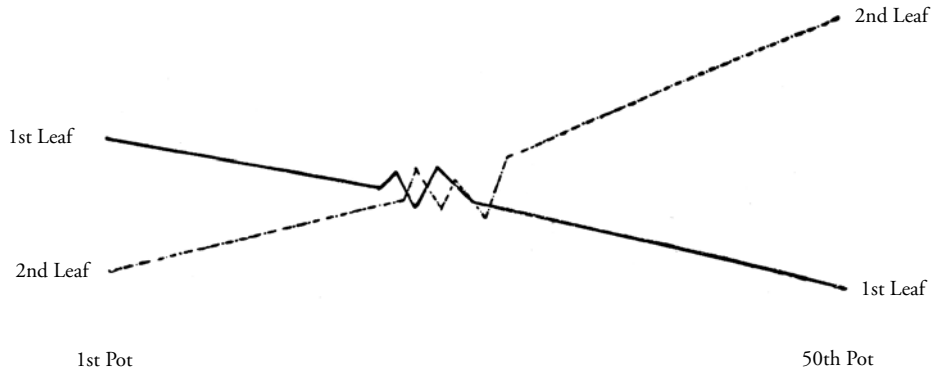


Fig. 58. Simplified diagram of the above graph

The graphs obtained for the weight are also of great significance. They are sub-divided into three phases: light – darkness – and the phase in between. Fig. 59 demonstrates this phenomenon quite clearly.

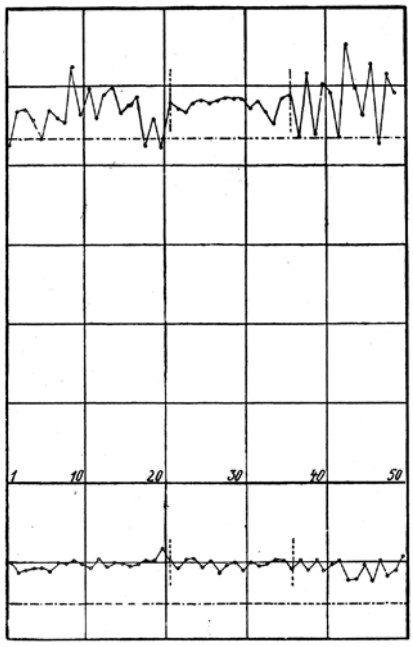


Fig. 59 Weight of the wheat plants grown in decreasing light, garden soil

Our next experiment consisted of three series to study the difference between our usual garden soil, the soil mixed with silica and a black soil containing active humus substances. Each series con hi hied twenty-five glass pots with thirty grains in each. This time we did not use electric light, only daylight streaming through the black channel. The first pot was nearly in complete darkness, the 45th was standing in plain daylight, and during the night the room was in normal darkness. The experiment was carried out for a fortnight. During the whole time it was seen that the "humus" series was retarded in growth, in comparison with the other two series.

The growth of the first leaf increases from light to darkness, or we can also say it decreases from darkness to light. The graph falls steadily in this direction from 24.0 cm. to 18.0 cm.

The second leaf has the opposite movement, it increases from darkness towards light, from 18.2 cm. to 20.5 cm.

The internode steadily increases with increasing darkness. Pots 1 to 31 show the influence of darkness; pots 32 to 42 – the second part of the graph – show the battlefield between light and darkness; pots 43, 44, 45 show the phenomenon of light.

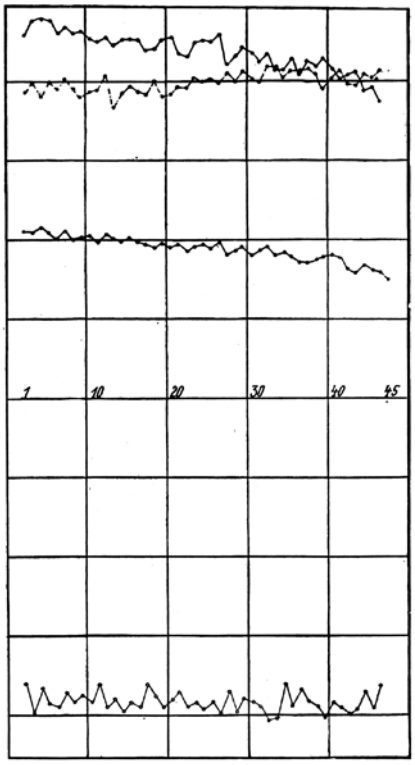


Fig. 60. Experiment with Wheat in decreasing daylight with garden soil

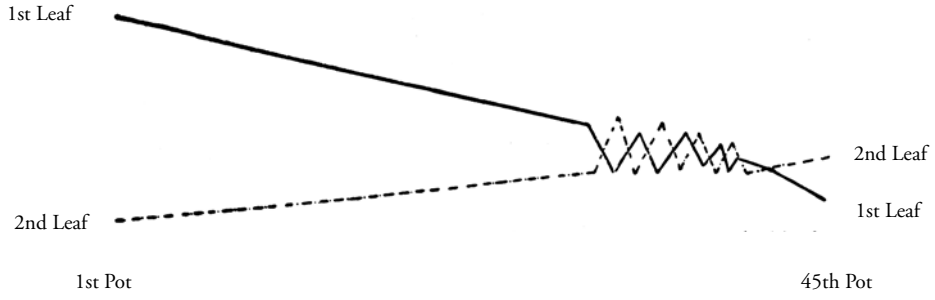


Fig. 61 Simplified diagram of the above graph

The next series contained a mixture of our garden soil with silica sand. We mixed the sand with the soil thoroughly.

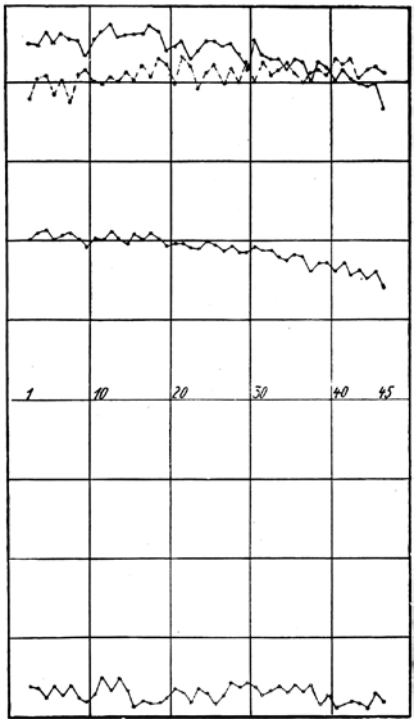


Fig. 62. Experiment with Wheat in decreasing daylight – soil mixed with silica sand

The growth of the first leaf decreases with increasing light from 23.5 cm. to 18. 3 cm.
The growth of the second leaf increases with increasing light from 19.0 cm. to 20.5 cm.
The internode slowly decreases from darkness to light, from 10.5 cm. to 7.0 cm.
Pots 1 to 28 show the influence of **darkness.** Pots 29 to 38 again the **battlefield between light and darkness.** Pots 39 to 45, light **influence.**

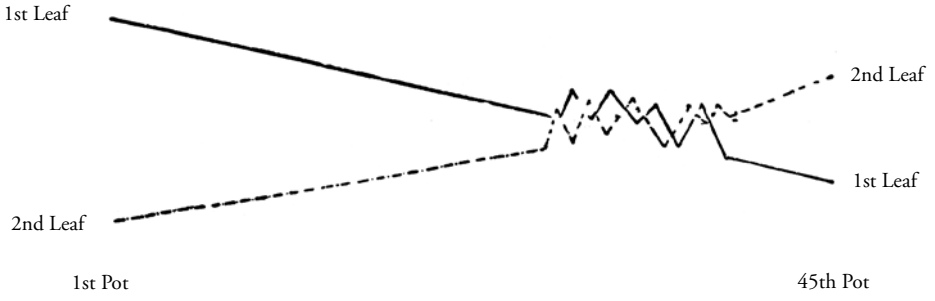


Fig. 63 Simplified diagram of the above graph

The third experiment with “humus”:

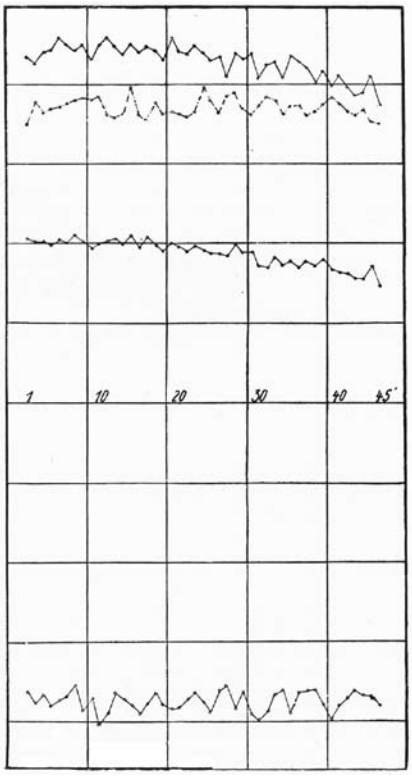


Fig. 64 Experiment with Wheat in decreasing daylight – plants growing in “humus”

The growth of the first leaf decreases with increasing light, from 23.0 cm. to 18.5 cm.
The growth of the second leaf slightly increases from darkness towards light.
The internode decreases from darkness towards light from 10,5 cm. to 7.3 cm.

There is not a single pot in tee whole series showing the influence of “light”.
The second leaf is always smaller than the first one.
There is no middle part where light and darkness fight with each other.
The experiment with “humus” shows only the phenomenon of “**darkness**”, which, of course, increases with increasing outside darkness.

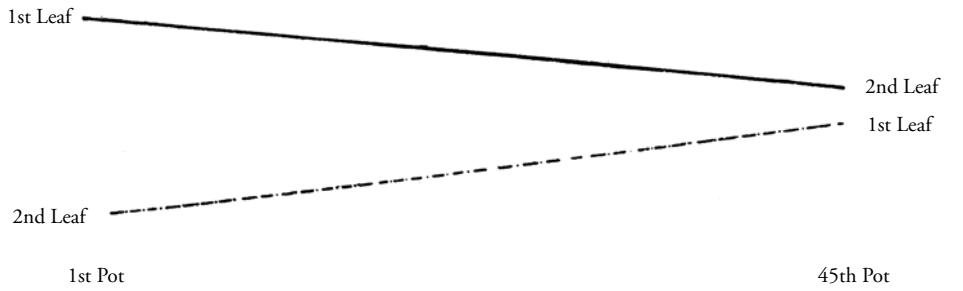


Fig. 65 Simplified diagram of the above graph

The result of this simple experiment is extremely interesting. Rudolf Steiner's assertion that silica activates the light in the soil, and "humus" brings about a "darkness" influence; or perhaps it is better to say it hinders the light from acting, proved perfectly true. The first experiment with garden soil had three pots showing "light"; the second experiment where silica was mixed into the soil, could show the phenomenon of "light" as far as the 7th pot. That means: in reality the external influence of light lessens from the 25th to the 39th pot, yet the plants still got light from within.

The third experiment proves that "humus" excludes the action of light. All the three series were exposed to the same amount of light, but the plants could not receive it in quite the same way, according to the varying composition of the soil.

These experiments have perhaps partly solved the question: What is the use of silica to plants? Silica is of no nutritive value for the plant; that means, silica is not considered to be necessary for plant life. It can easily do without it. But silica is everywhere, even in the atmosphere, so, although it has no actual nutritive value for the plants, it helps them to receive different cosmic entities which they need at least as much as the nutritive substances. Without the cosmic entities streaming through them and through the soil they would not be able to use the food offered to them. Silica activates the light in the soil; that is a cosmic entity. Light does not belong to the earth, it comes from the cosmos.

Certain plants, especially roots, require a sandy soil if they are to prosper. Carrots, beetroots, celeriac, and potatoes grow best in a sandy soil, because silica helps them to obtain light inside the soil.

Other plants which like to grow in a sandy soil are, for instance, Achillea millefolia (Yarrow), Plantago (Plantain), in mountain regions primula acaulis, gentianas acaulis, carlina acaulis. The name "acaulis" means "stemless". These plants produce only a tiny stem. This reminds us of the characteristic phenomena described in our experiments, namely, that light shortens the internodes, shortens also the first leaf, and enhances the growth of the roots. The green colour of the shortened stem is darker, and also the green of the leaves is more pronounced.

The stem has more of the character of the leaf. This fact is also mentioned by other scientists. Intense electric light can produce chlorophyll even in the inner bark of woody plants. The plant is, as it were, pushed back into the soil.

Darkness, on the other hand, changes the stem in the other direction, it grows longer and becomes silvery white like the roots, and the roots are shorter. The plants are driven out of the soil.

In mountain regions it is obvious that plants get more light, so they show these characteristics in their growth.

Chapter VIII
THE SILICA PREPARATION FOR AGRICULTURAL PURPOSES ACCORDING TO RUDOLF STEINER'S SUGGESTION.

Sometimes we have a soil which has not enough silica, but which is rich in humus: a heavy soil. So we must introduce silica. Rudolf Steiner suggested the *homoeopathic use of specially prepared silica.* For several years we had studied the .influence of minute quantities, or "smallest entities." Rudolf Steiner mentioned these investigations which had been carried out in the Biological Institute at the Goetheanum (Stuttgart) when he suggested using certain substances in **homoeopathic quantities for agricultural purposes,** because now there was a tested scientific basis for it. Smallest entities produce immense effects on plant growth, and, when used as remedies, on the human organism also. He suggested that silica should be pulverized very finely like flour. Then it should be moistened with water to make a thin paste, and a **cow's horn** filled with it. The horn must be buried in good soil about half a metre deep and left there during the summer. This procedure concentrates the qualities inherent in silica, and makes it extremely useful for agricultural purposes. In autumn the horn is dug out of the soil and kept until wanted.

For one acre of land we use 1 gram of this silica dissolved in about 10 litres of rainwater. The most important thing is to stir this small quantity of silica in the 10 litres of water; it must be done quickly, and with a wooden stick, stirring in one direction until the water forms a deep whirlpool, then it must be stirred in the opposite direction, and so on for at least one full hour.

Two questions arise: (1) Can silica be potentized? For it is not soluble in water. (2) Is the silica which has been kept in the cowhorn and buried in the soil during the summer, any different from ordinary silica?

Substances which are not soluble can be potentized from the homoeopathic point of view. The substance has to be ground and pulverized with a special machine, sometimes for many hours. Then one part of it is mixed with a more or less neutral substance – lactic sugar – and worked into the lactic sugar with the same machine for about two hours. A microscopical examination will show whether the mixture is a homogeneous one. That is the 1st potency. Again we take 1 part of the 1st potency and mix it with 9 parts of lactic sugar, and work these two substances together for two hours; then we have the 2nd potency, and so on. Years ago we studied the difference between potencies made by this "dry" method, and potencies of soluble substances dissolved in water or alcohol. We will give one example – for instance, **sulphur** rubbed into lactic sugar.

One gram of the 1st potency is dissolved in 10 cm. of water; 1 gram of the 2nd potency in 10 cm. of water, and so on, until we have 30 potencies dissolved. Seeds of wheat are inserted in these solutions until germination begins. Then the seeds arc placed in glass dishes with garden soil and are allowed to grow for a fortnight. During this period they are only watered with distilled water.

We see the first maximum at the 7th potency, the first minimum at the 12th, the second minimum at the 28th potency; the second maximum at the 23rd; A doctor will know how these potencies affect the human organism. The patient takes a small amount of the white powder which many people might think is only lactic sugar; but if an experiment is made with plants, the living organism of the plants reveals the specific power of each potency. Therefore we must conclude that **insoluble substances can also be potentized.**

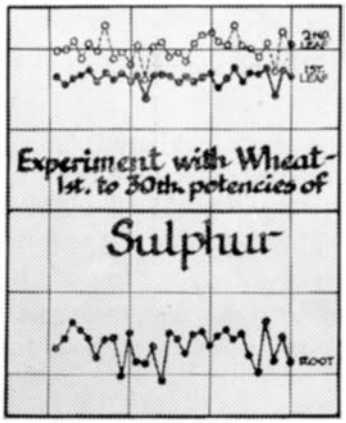
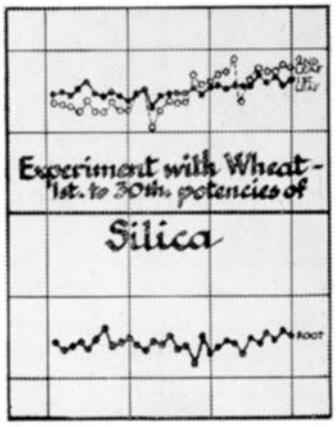


Fig. 66 Experiment with Wheat, 1st to 30th potency of Sulphur

If that is so why should it be impossible to potentize silica? We pulverize rock crystal to a consistency of fine flour – it takes a long time, of course – then we potentize it with rainwater and insert the wheat. This experiment was continued till the 60th potency. Only the first half is reproduced here, because for agricultural purposes we need not make use of higher potencies.



Fig, 67. Experiment with Wheat, 1st to 30th potency of Silica

The water control indicates that the first leaf is longer than the second, that means not much light. The experiment was carried out in 1931 in the second half of May. It is quite an interesting graph. All the potencies show improved growth compared with the water control; slowly increasing at the beginning until the 5th potency, then decreasing until the minimum is reached at the 13th. At the 18th the second leaf becomes longer than the first (light influence), the maximum is reached at the 23rd; then the first leaf is again longer; and for the rest of the graph, the second.

The internode varies, but usually is shorter than the water control (light influence).

The roots reach the minimum very early at the 7th and the maximum at the 18th potency.

The next problem is: if we put the silica in the cowhorn and bury it beneath the surface of the soil during; the summer, does this strange procedure change in any way the qualities of the silica? We must confess, that when the silica is taken out of the soil, it looks different, although it is difficult to say how. Perhaps it is not so "white", as it was before.

We try to solve this new problem by the same method. We potentize the "prepared silica" and start our experiment at the same time as the previous one.

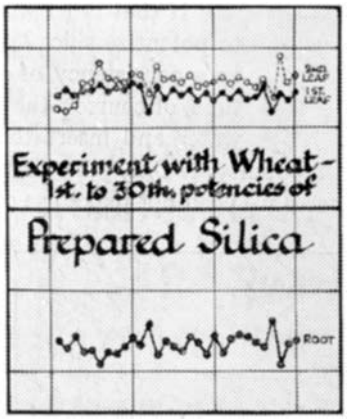


Fig. 68 Experiment with Wheat, 1st to 30th potencies of "Prepared Silica"

This graph looks different. It is best described by saying it looks more harmonized. The first maximum is reached at the 6th potency, the second leaf is longer than the first one. That means "light" from within. The unprepared silica has the maximum at the 5th, but the "light phenomenon" is not to be seen. So we must conclude that the "prepared silica" exercises a stronger influence.

The first minimum occurs at the 12th, a distinct second minimum at the 27th, a second maximum at the 28th. The internode for the greatest part of the graph is shorter than the water control (light phenomenon).

The roots have the first maximum also at the 6th, the second at the 28th the first minimum at the 12th, and the second at the 27th potency.

Prepared silica differs favourably from unprepared silica.

If these experiments are repeated for years, differences will be found. Every year is different from another. The conditions beneath the soil are different in 1931, from 1932, or 1933, and so on. In order to demonstrate the difference between different years we give an account of the experiment carried out in the same way during summer 1934. That is to say, the cowhorn containing silica was buried in the soil in summer 1933, and the experiment was carried out in the second half of May 1934.

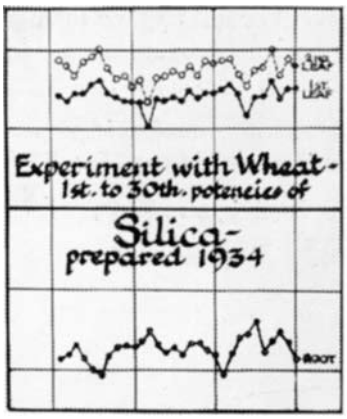


Fig. 69 Experiment with Wheat, 1st to 30th potency Silica prepared 1934

The water control indicates that the first leaf is smaller than the second, and that means „ light." Although the experiment was carried out at the corresponding time of the experiment in 1931, we find that more light was available for the plants. This fact changes accordingly the whole graph. The second leaf is longer from the 1st to the 30th potencies. The first maximum occurs at the 6th potency (exactly the same point, only stronger), the second maximum at the 28th (also the same point). The first minimum is at the 12th, the second at the 24th potency (three potencies earlier).

The internode is shorter than the water control for all potencies (light phenomenon).

The roots have the first maximum at the 6th, the second at the 21st potency;

the first minimum at the 12th, and the second at the 25th potency.

For the most part, the graph of 1934 is identical with the graph of 1931.

Silica has proved useful indeed for increasing plant growth in the garden as well as in the field. It is only applied to green plants. It is of no use spraying silica on the bare soil before the green leaves are there. Rudolf Steiner suggested taking quite a small amount of the prepared silica, the size of a " pea," or even only the head of a pin, and stirring this into about 10 litres of water. But the mixing process has to be done very carefully, for at least one hour as previously described.

But something else is also most important. Silica has the capacity to mediate the cosmic influences of light, but it is also closely connected with warmth. The right way of stirring the silica is to use only **warm** water.

One gram in 10 litres is about the 4th potency. According to our experiments the best result was obtained using the *6th potency*. Having stirred the silica into warm water, this liquid is sprayed or sprinkled on the top of the green plants. They are helped in their growth, they can produce more chlorophyll, they develop into strong plants. 10 litres are enough for one acre.

Many farmers and gardeners have used this prepared silica with good results Control experiments show an increased harvest for different grains from 10-30%.

It should also be used for leguminous plants, and for carrots, beetroots, turnips and potatoes, in soils lacking silica.

Chapter IX.
THE SILICA PLANT – Equisetum arvense (Horsetail)
as a remedy for various plant diseases

This plant likes to grow in fields, meadows, and uncultivated sandy soil. It is rough to the touch, reaches a height of about 16 inches, blooms in March-April; and produces its vivid green sterile shoots after the decay of the reddish-brown fertile shoots in June-July, when it is best to gather them. Equisetum is a **silica-plant.** It is a real gatherer of silicic acid in the first place. Of course there are many other substances to be found in this plant, like oxalic acid, equiset acid, bitter substances and resin. The ashes contain much aluminium, potassium chloride, etc. It is well known as a medicine since earliest times. We find it described in Culpeper's **British Herbal**: "there are many kinds of this herb, which are but knotted rushes, some with leaves, and others without. The great Horsetail at the first, has heads resembling asparagus and afterwards grow to be hard, rough, hollow stalks, joined at sundry places at the top, a foot high, so made as if the lower parts were put into the upper, where grow on each side a bush of small long rush-like hard leaves, each part resembling a horsetail. At the top of the stalks come forth small catkins, like those of trees. The root creeps in the ground, having joints at sundry places. This herb grows in wet grounds. It springs up in April, and has its catkins in July, it seeds in August and perishes in winter. Government and Virtues: this herb belongs to **Saturn.** It is very powerful to stop bleeding either inward or outward, the juice of the decoction being drunk, or the juice, decoction or distilled water applied outwardly… The decoction, taken in wine, provokes urine and helps the stone and strangury. The juice or distilled water used as a warm fomentation is of service in inflammations, pustules or red wheales and other breakings-out in the skin."

Pliny mentions equisetum also, and says that it has a great power of stopping ' bleeding; it would even be sufficient to hold the plant in the hands. He speaks of it also as a remedy for diseases of the spleen.

Albertus Magnus (12th century) mentions the same qualities.

In our present-day medicine we find horsetail used again as a remedy for kidney diseases, for haemorrhage of the lungs, or stomach; it provokes urine and in homoeopathy it is used for cystitis, strangury and dropsy.

Rudolf Steiner suggested equisetum as a wonderful remedy for plant diseases. Of course we have to be careful in speaking about "plant diseases". There are no plant diseases in the same sense as that in which we speak of animal diseases. An animal falls ill in a different way. "There are inner organs which can get diseased, inner causes of illness, whereas if we study plant life we always find that plants get diseased from outside. Either it may be the wrong composition of the soil, the natural balance in the soil being disturbed, so that the plant cannot get the right food, or in some years the weather conditions are unfavourable, there is too much water or not enough water, and so on.

If a plant is diseased it means that the normal contact between the plant and the universe has been disturbed. The plant is originally healthy and we have to bring back the plant to this natural condition.

Very often we find that insects, or caterpillars attack plants only when something is not in order in the general life of the plant. To combat these diseases means simply to strengthen the

vitality of the plant. There are nearly as many damaging insects as there are plants. To-day we fight against these pests with many chemical substances. A whole industry has been created to combat them.

In Part I, Chapter II which deals with the influence of the moon on plant growth, it was pointed out that the forces of the moon are mediated through water. If there is a full moon and some days previously there was rain, so that the soil is well moistened, then we have the best natural conditions for putting our seeds in the soil. They will sprout quickly and grow into strong, healthy plants. Plant-life makes use of the forces of the full moon with the help of the moisture of the soil. In a perfectly dry soil, even the best forces of the full moon could not help. Moon and water belong together, as do **silica** and **warmth**. These give us the best conditions.

Sometimes it happens that the moon acts too strongly, and that is when there is too much moisture during the full moon period. Too much life is generated and **too much life is as bad as not enough life.** The former provides just the right conditions for different so-called plant diseases. Parasites increase, pests appear and fungi. There is too much " moon " in the soil, too many life forces, and we have to re-establish the right balance with equisetum.

Rudolf Steiner suggested making a rather strong tea of equisetum; then diluting the tea and using it in homoeopathic quantities for the diseased area.

We studied this problem carefully. At first we made the tea (1 part of the drug to 10 parts water=10%); we brought it to boiling point, and then let the tea simmer slowly for about one hour. It is necessary to boil equisetum for rather a long time. The tea is of a light green colour, and we found it best not to use it immediately, but in a few days' time, when a certain smell is developing.* We made our usual experiment to find the right potency. We potentized until the 60th potency, then inserted the wheat into the different potencies, and watched the different growths for a fortnight.

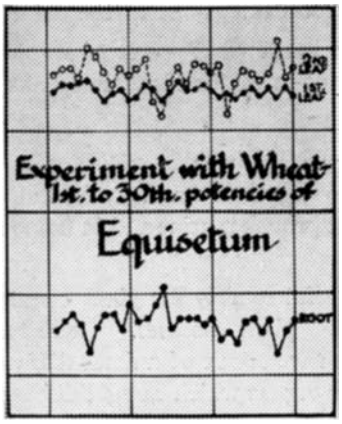


Fig. 70 Experiment with wheat, 1st-30th potencies. Equisetum Arvense

Here we see an quite energetic graph. The first maximum is at the 5th potency; the second at the 28th; the first minimum at the 14th; and a second at the 21st potency. The first maximum

* See capillar dynamolytical test on next page.

shows prominently the second leaf much longer than the first one, and indicates a strong "light" influence of the silica substance, and that is just what we need to oppose the too strong moon influence in the case of plant diseases.

The first and second minimum show the opposite effect on the leaf; the first one is longer than the second. "Darkness" prevails.

The roots have as minimum the 14th, and maxima the 6th and 28th potencies.

Having thus ascertained the right potency of equisetum, we treated all kinds of plant diseases: fungi and mildew, and pests with the 5th potency, with excellent effect.

In some cases we can also use the "prepared silica" 6th potency to obtain the same result. For instance, lice on broad beans can be attacked successfully with a spray of prepared silica. Only it must be done at the right moment. Here it is suggested that prepared silica and not equisetum should be used, because these lice do not appear because of too much " moon " in the soil; they appear at the time when the growth of the beans is checked perhaps through cold weather or drought, and if we can stimulate growth in time, we help the plant to resist the attack of the lice.

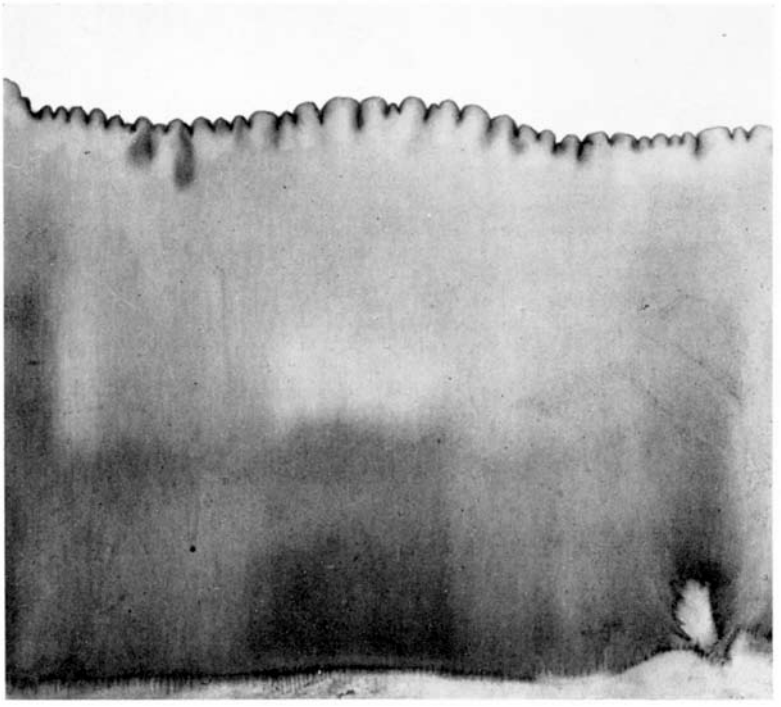


Fig. 71 Equisetum Tea, fresh; followed by 1% gold chloride

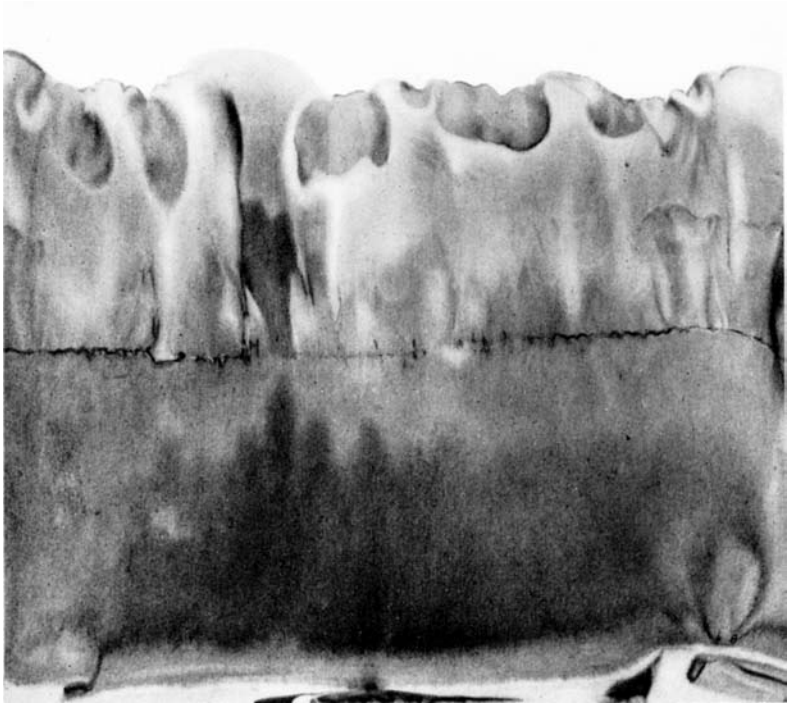


Fig. 72 Equisetum Tea matured until the characteristic smell develops, followed by 1% gold chloride

Chapter X.

THE CALCIUM PROCESS IN NATURE.

Calcium also, like silica, plays a great part in Nature, and farmers and gardeners have to know something about the calcium content of their land. Our first question must be about the origin of calcium on our planet earth. Where did it come from? Huge mountains are built up from this substance.

The limestone we find in the South Sea Islands originated from **corals;** that means it comes from the animal kingdom. Much of the mountain region in the Alps, is also built up from corals (the Bavarian Alps, Wetterstein Mountains, Jura Alps, etc.). We find everywhere that limestone originates from the shells of living beings. If we look at **marble**, for instance, the pure, white, crystallized Carrara marble which is used for sculpture, for building material, etc. – it seems to be a perfectly lifeless mineral matter. But here and there we find petrified corals in the quarries.

Of course lime can be dissolved in water (not so silica), then it re-crystallizes and looks like dead mineral matter, with no connection whatsoever with life. Nevertheless, **calcium** originates from living beings.

We have already mentioned the publication by Professor Vernadsky, the Russian geo-chemist, and must mention him here again, because he has collected an immense amount of material which proves beyond any doubt, that all the lime we find on earth has been derived from living beings: "omni calx e vermibus". Dover cliffs consist of pure white chalk, the deposit of millions and millions of shells from tiny living creatures, the Foraminiferae.

And as for **Coal** – everybody knows that it is the remains of plants belonging to previous epochs of the earth's evolution. The same can be said about **Slate**.

To-day science is coming to the conclusion that nearly all the mineral deposits are derived from living beings, that they are the remains of plants or animal skeletons.

It is interesting to remember how geological classification came about. An Italian scientist, standing in the Plain of the Po and looking towards the Alps, noticed that different layers were to be seen in the rocks, and he called the lowest one the "primary" rocks, the next layer "secondary", and the next "tertiary" – these are the limestone formations; and the next was the "quaternary" (Alluvium). That is the origin of our geological classification. At present we count some twelve or thirteen layers, because later some sub-divisions were made.

In these different layers of the earth the remains of specific animals are to be found. The geologists call these animals index fossils. In a particular layer certain specific shells or snails are to be found – so wherever such fossils appear one is able to say to which geological period they belong. Thus the principles of geology are based on the presence of certain petrified animals. The older layer which does not contain fossils is called "archaic".

The question is: Do we not find specific animal residues there because there was no life? Or is it possible that everything was life, that the whole was permeated with life?

If we study geology, and see how much life there has been everywhere, we cannot really think there can have been any epoch in our earth evolution when there was no life at all. There is a certain place in the Jura Mountains – Holzmaden – where nearly all the huge petrified animals have been found, and which now can be seen in various museums all over the world. In Holz-

maden (Southern Germany) we find the Triassic Slate Formation. This layer is full of animals. Life cannot be created out of dead matter, but it is the life-access, which deposits dead matter. As in a swamp, where all is permeated with life, with slugs and worms and insects, etc., so we have to imagine that once our earth was in a more liquid condition – between solid and liquid – but full of life. **The whole of earthly matter was living substance.**

If we can grasp this, then we can understand better how the whole mineral kingdom of our planet earth has originated out of such living creatures. The earth as a whole was once a huge living being.

There is ample material to prove this as far as the **lime** and **calcium process** is concerned, and also for many other processes in nature. The Russian scientist Vernadsky, who has made extensive geological investigations, is convinced that living beings and dead matter have always existed side by side. He is convinced of the "eternity of life on earth". Life, as such, has never been created on earth – but dead, lifeless matter has originated from the life-process itself. For instance, a living substance like protoplasm, contains many different substances which cannot be discriminated from one another so long as they are in the living organism. If the living organism is killed, then, of course, all the different substances become apparent. In a similar way, life was interwoven in the origin of our planet earth.

In speaking of **Silica,** its resistance to heat and to acids was mentioned, and that it is insoluble in water. Neither heat nor water affect it. With calcium it is different. If we want to understand calcium as a substance, then we must observe, for instance, how it slowly crystallizes out of the water. It is deeply connected with water, but has also the tendency to form a deposit. But lime can only be dissolved in water, if-there is also a certain amount of carbonic acid present. If the carbonic acid evaporates – lime is deposited.

That is a general law we find in Nature. If out of a medium something evaporates into the air, another part solidifies, and falls to the earth.

So we see the lime wandering between the solid and the liquid state. This substance has a certain desire, as well for the one as for the other kind of existence. It is eager to be dissolved in water – but it is as eager to fall out as a deposit again. This process is carried out with the help of the carbonic acid. In the sea there are thousands of species of animals and plants which collect calcium. In the living organisms we find exclusively calcium-carbonates.

Calcium-sulphates are deposited from concentrated solutions, where there is no more life left. Calcium sulphate or gypsum can be dissolved in water. For instance, all the Italian mineral waters contain some sulphur. In gypsum we have not only the qualities of calcium, but those of sulphur as well.

Calcium carbonate can be dissolved in water containing a surplus of carbonic acid; it can be burnt and the carbonic acid driven out; and then we get quicklime. If lime is heated it begins to emit light, the so-called Drummond's lime-light. This burnt lime has an enormous desire to get into contact with water. If it is slaked the water disappears rapidly into the lime, and begins to boil. The lime has become an alkali.

Calcium Nitrate is formed during the disintegration of nitrogenous organic substances in the presence of calcium.

Calcium Phosphate treated with sulphuric acid, becomes soluble in water; mixed with calcium phosphate in about equal proportions, it is used as a "fertilizer" under the name of super-

phosphate. Lawes of Rothamsted worked out and patented in 1842 a method for doing this on a large scale. This was the first artificial fertilizer.

Calcium fluoride we find in Nature, sometimes in beautiful crystals, as fluorspar.

Again we turn back to **silica.** It was said that silica is found more on the surface of the earth and less the deeper we go down beneath the surface. The plants deposit silica more or less in their peripheric parts. In the animal kingdom we find it also more or less deposited in the peripheric organs, or forming the shell of the lower animals. The same phenomenon happens in the human organism, where silica is to be found in the skin, nails, hair, and eyes.

Lime, on the other hand, withdraws inside the human body and forms the skeleton. If we look at the way the different substances are distributed in Nature, in all the different kingdoms of Nature, if we try to follow up the steps that are made, then we get a better understanding of what we have to do in agriculture. We must grasp the whole **process:** the silica-process, the calcium-process, the sulphur-process, the nitrogen-process, etc.; a "process" embraces much more than substance alone.

In the Introduction of this Second Part, we mentioned experiments with calcium hydroxide, and showed the effect of "smallest entities" by means of illustrations. Only a few of the experiments carried out with calcium can be described.

Chapter XI.
Experiments with Gladioli, 1st to 30th potencies – Slaked Lime

Carefully selected bulbs of gladioli were inserted in the potencies and kept until germination set in. Then the bulbs were transplanted into the garden and the treatment with calcium potencies was discontinued.

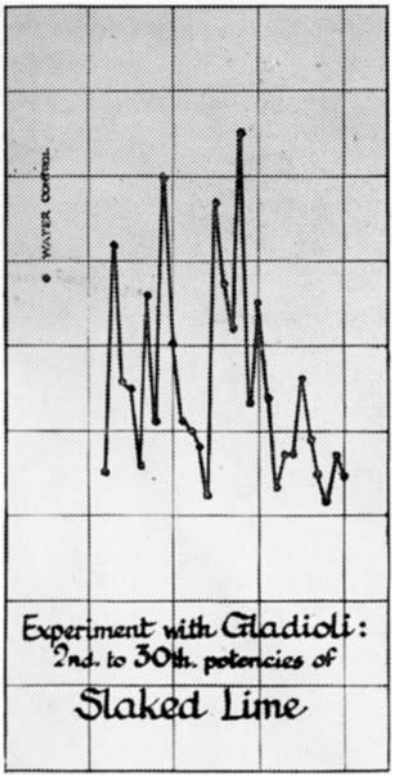


Fig. 73 . Graph of the Experiment with Gladioli grown under the influence of 1st-30th potencies – Slaked Lime

The plants treated with the 1st potency of slaked lime cannot grow at all; the 2nd potency plants are much smaller than the water control and unable to produce flowers. The 3rd potency is too much enhanced in growth for the real benefit of the plant; the 4th is again smaller than the water control; a second jump happens at the 9th potency. The first minimum appears at the 14th; the maximum at the 18th potency. A second minimum is visible at the 28th potency.

Another experiment carried out with **quicklime:**

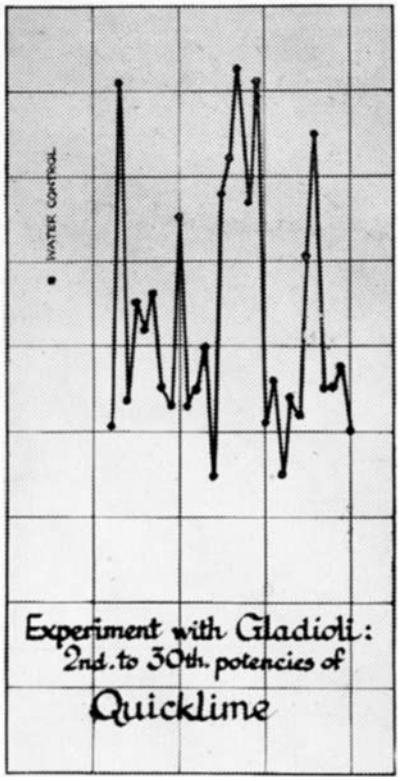


Fig. 74
Graph of the Experiment with Gladioli grown under the influence of 1st-30th potencies – Quicklime

Quicklime also hindered the growth of the plants treated with the 1st potency; the 2nd potency is smaller than the water control plant, but better developed than the identical potency of slaked lime. The 3rd jumps even much higher and the following potencies fall again back under the water control level. The first minimum is reached at the 14th, the second at the 22nd potency. The maximum appears at the 17th. The 26th might be considered as second smaller maximum. There is a certain similarity between these two graphs, but quicklime is more distinct in its character.

Experiment with the much used fertilizer – **Nitro-chalk:**

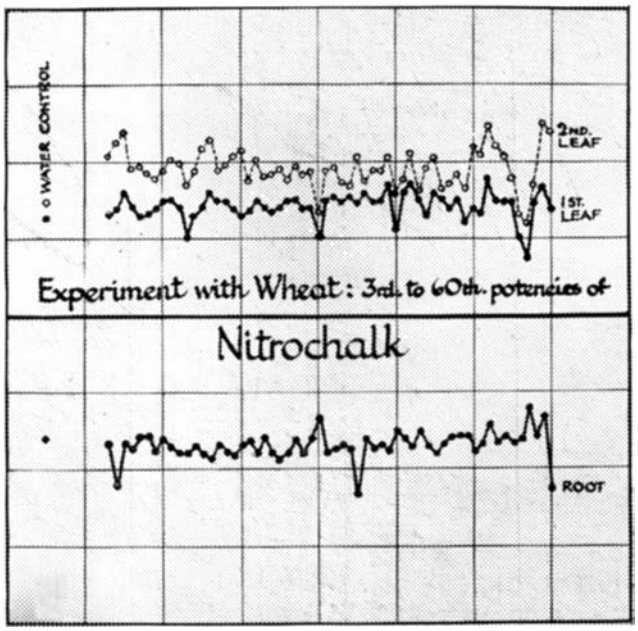


Fig. 75 Graph of an Experiment with Wheat growing under the influence of 1st-60th potencies of nitro-chalk

The graph represents one unit. There is only one phase between 60 potencies. There are two strong minima: the 30th and 57th potencies, and two smaller ones:

13th* and 40th; two maxima: 52nd and 59th potencies.

The roots show three maxima: 4th,: 35th and 60th potencies, and two minima:

30th and 57th potencies. The graph is very harmonious and distinct in every detail.

The first two potencies did not cause germination at all, and the third was already much advanced in comparison with the water control. We refer to Chapter XIII dealing with "The Problems of Artificial Fertilizers", where we point out that the eye specialist, Dr. Thies, wrote about the danger of using nitro-chalk as a fertilizer; that the farm labourer who handles it gets inflammatory processes on the conjunctiva and cornea very easily.

* We refer to the 13th potency as a smaller minimum because the second leaf is not following the downward movement of the graph as distinctly as it is the case in the 30th potency.

Chapter XII.
SUGGESTIONS FOR THE HOMOEOPATHIC USE OF LIME.
What can we do to bring lime into soil which has an insufficiency of this process?

We have mentioned this in the introduction to the Chapter, "Smallest Entities in Agriculture":

(1.) We distribute lime in a certain potency over the surface of the soil which lacks lime. According to our experiments, we suggest using- the 9th or 10th potencies. This is very **economical.** We owe a great debt of gratitude to Dr. Rudolf Steiner for his idea of introducing the homoeopathic principle into agriculture.

(2.) In making compost heaps (see Chapter IX, Part III), we spread a thin layer of quicklime between the layers of the material that are used.

(3.) In the **Oakbark preparation** (see Chapter III, Part III), we introduce calcium again in homoeopathic quantities into the manure or compost heaps. This calcium comes from the living plant process in the oak tree, and has the faculty of acting prophylactically against "plant diseases." In those cases where plant diseases are to be dealt with and where calcium must take the place of a **remedy,** it is better to take it from a living plant-process and not in its more mineral form as quicklime.

The oakbark preparation has to undergo a special composting process in the skull of an animal. Thus, as a surrounding for the calcium-containing oakbark, that part of an animal which is also built up of calcium – the bony structure of the head – is used.

If we adopt these suggestions, the soil receives all it needs of calcium **forces,** and we need not dig in large quantities of it.

Chapter XIII
ARTIFICIAL FERTILIZERS.

There already exists such a vast literature about artificial manuring, that it seems almost superfluous to write more about it. Although so many have written about their experiences, farmers and gardeners are still using artificials to a high degree. They have not yet understood that they are rapidly poisoning mankind.

Well-known scientists such as Professor Abderhalden spoke 20 years ago, about the possibility, that in the long run artificial manuring might damage the organic life of the soil. Substances of paramount importance might not be able to develop. In some cases human beings and animals became ill, and the illness was due possibly to artificial manuring. Such scientists admitted that it was not then possible to speak definitely, but said it had to be borne in mind that certain soil bacteria (which are very important for fertility of the land) might be harmed, and it might be unwise to disturb the subtle interplay of all the living organisms through the application of nitro-chalk, lime, phosphoric acid, etc. Some day difficulties might arise. That is what was said twenty years ago.

Is it not strange to imagine the farmer walking over his land and poisoning it purposely? He has to protect *himself* against the artificial manure he is using, or he may suffer injury. For instance, his eyes are in danger. An eye specialist. **Dr. O. Thies** wrote about this problem in 1929 (**Deutsche Landwirtschaftliche Presse,** 6th April, 1929). He enumerates the different artificials, and speaks about the specific damage they produce. Thomasschlacke (Basic Slag) contains phosphoric acid, silicic acid and quicklime; they are apt to damage the conjunctiva and cornea of the eyes.

The effect of Cainit is similar, but even more damage may be done to the cornea.

Nitrochalk also gives rise to inflammatory processes on the conjunctiva and cornea. All those who work in nitro-chalk factories show these symptoms. It has even been noted, that once a farm labourer got some of the nitro-chalk into his mouth, nose and eyes on a windy day. He became delirious and complained of headaches, due to the phosphoric hydrogen being generated through the contact of humidity with calcium carbide.

Ammonium sulphate has the same effects as those mentioned above.

Nitrophoska and **superphosphate** are much more dangerous. Nitrophoska contains a mixture of nitric acid, phosphoric acid and some potassium salts. The injury caused to the eyes is very severe. Heavy inflammations, changes in the cornea, sometimes tumours and even complete loss of the eye may follow.

Still more harmful is the use of superphosphate.

That is the opinion of an eye specialist who had to deal with effects of artificial manures on people whose job it was to work with this material.

But it is not only the eye which may suffer. We read also about severe **lung disease** caused through the influence of artificials. Workmen who are constantly mixing those substances in the mills, may get some of the powder in their respiratory system, and then malignant diseases of the lungs, start, which often prove fatal.

Of course, farmers and gardeners who are not in constant contact with these substances, are less liable to injury from them: Then it is considered to-be more or less accidental.

Perhaps the farmer has some open sores on his hands, and the powder enters through them into the circulatory system and leads to blood poisoning. **Or** if the farmer happens to have an inflamed throat at a time when he is scattering the powder on his land, then the powder may affect the respiratory passage which is already inflamed, and such cases may also end fatally.

One is therefore officially advised not to let persons deal with artificial manures who have open wounds or furunculosis. Especially when using nitro-chalk, it is advisable to have the body well protected, to wear heavy boots, to protect the eyes with glasses. It is wise to have grease on the unprotected skin, and cotton-wool in the nose, and to keep the mouth shut. It is better to breathe outside the clouds of powder.

Who would imagine that a farmer has to do all this in manuring the land, which afterwards has to bear fruits for human nourishment? :

That is only the first part of the treatment; **the soil gets poisoned.**

The next step has to do with the seeds. The **seeds** have to be **protected** against diseases which might attack them. So they are dipped into a solution which contains **quicksilver.** Then they are well protected. The amount of quicksilver is relatively small, and anyhow, one is not obliged to eat the seeds which have been treated with that "protective" solution; and, of course, the plants which grow out of these seeds cannot contain quicksilver.

Some scientists have investigated carefully, to see if the new plants were free from quicksilver, and came to the conclusion that there is still a tiny amount of it to be found. Prof. Stock*, in particular, made many experiments in this direction. He had himself once suffered from the consequences of severe quicksilver poisoning, so it is understandable that he was interested in studying this problem thoroughly Prof. Stock even found, small quantities of quicksilver in **bread.** Of course these quantities were very small and could only be found by extremely subtle chemical tests. Such small quantities are not harmful – so science says. But, perhaps, after some time, if people go on eating small amounts of quicksilver in their daily bread, those quantities accumulate in the organism and then suddenly quicksilver poisoning arises. That is another point of view some scientists take.

Of course it is not enough to protect only the seeds, something has to be done about damage caused through various insects, caterpillars, etc. on fruit trees. Let us poison them, too. This time we take **lead arsenic** for a change. It is a pity that all the bees seeking their share of honey are killed by sucking deadly poison, out of the flowering trees. Never mind, we have saved the harvest, and, of course, the fruits will not contain any poison.

Perhaps some readers will remember that from time to time people have been advised in the daily papers to peel the apples they eat, because there might be some arsenic in the skin. It cannot be washed off. So we have the substantial influence of lead on the skin of the apple, and the non-substantial, radiating influence of lead **in** the apple.

Once somebody had the bright idea of powdering the forests from aeroplanes. This method has been tried in America in 1921, and, later on, in Germany. It seemed quite successful as far as the trees were concerned. It was not quite so good for the animals. Many rabbits, hares, deer and birds were killed. It was supposed that the birds had eaten the poisoned caterpillars. Is it not

* Geht Quecksilber aus Saatgut-Beizmitteln in das geerntete Korn und in das Mehl über? Prof. Dr. Alfred Stock und Dr. Zimmermann. Zeitschrift für angewandte Chemie, 41, Jahrg, Nr. 51. (Does Quicksilver, contained in preparations for the treatment of seeds, enter into the harvested grain and flour)

really a vicious circle in which we are going round and round, and do not even notice it? We save the trees and kill the animals. We protect the seeds and make human beings ill.

Why must we work against Nature? Should we not try to understand and help Nature?

The list of poisons is not yet finished. Another very well-known and commonly used poison is **Copper.** To combat the Peronospora disease which attacks the vine, the plants are again and again sprinkled with copper sulphate. What happens then? At first the earthworms disappear from the soil. They are not fond of copper. Consequently the soil begins to lack humus. But of course, we manage to combat Peronospora. Slowly we must increase the amount of copper if we are to continue to get good results. Who has not seen vineyards with the grapes hanging heavily on the branches, and covered with a blue mm of copper sulphate, all the green leaves vigorously sprinkled with copper? Sometimes people wonder if they do not eat copper when they buy grapes.

Let us briefly review what is to be found in literature about the treatment with copper. The juice of grapes in the year 1930 contained in a certain district, a considerable amount of copper, about 30 to 50 milligrams in a litre.

Animal diseases occurred after the use of copper sulphate against insects on fruit trees in many districts. The disease is vividly described. Changes **occur in the liver and kidneys** of the animals. The cells are destroyed in these organs owing to the accumulation of copper. Jaundice occurs and damage to the red blood corpuscles. Certain changes take place in the heart. There are swellings on the head, especially on the ears, and sometimes blood in the urine. These diseases occurred shortly after the land had undergone the copper treatment. The animals fell ill about two or three months afterwards. In many cases the illness was fatal.

If we study the effect of copper poisoning upon the human being, we find it described as causing shrinking of the liver. Gallstones contain a considerable amount of copper. Medical science states that this special illness of liver shrinkage and gallstones was formerly not so frequent. It is even possible that people who drink wine, may, at the same time, imbibe copper. And it has frequently been stated that people suffering from the above diseases were in some way connected with the cultivation of the vine.

It is also known that labourers who have to sprinkle the copper solution on the vine-plants, acquire kidney diseases. Occasionally they get eczema, behind the ears.

Sometimes we have **too much science** and **not enough wisdom or knowledge.**

The word "science" has, for many people, a magical sound. If something is "scientific" then it must be all right. So science took possession of agriculture, or we may also say "agriculture became possessed by science". The chemist tells the farmer what he has to do. The chemist is quite right in his sphere, but he is wrong when he touches agriculture. The farmer has lost his knowledge of the forces which work in Nature, he has lost the knowledge of the whole Universe, and has made a poor bargain in exchanging his old wisdom for the new science.

Science could be a wonderful achievement of mankind if we could carry it so far that it again reaches the realm of Spirit. Science alone is not enough. **Our science has lost its contact with life. It is pure science, and that is like the pure substances which are chemically perfectly clean, they are quite pure – but – you cannot live on those pure substances – you must add the vitamins – the life-bearers.** We do not know really what vitamins are – but without them foodstuffs are useless. They cannot support life. So "pure" science is not enough.

Science must find the way to the true fountains of spiritual life – and be transformed into wisdom.

We need new scientists who will endeavour to become pioneers for the spirit; scientists who really understand what **matter** is; who know that behind matter is the spirit. We can never understand matter, if we do not know its background, and whence it comes.

Mankind has been fascinated by the word "scientific". Everybody wants to be scientific – but feels almost ashamed to mention the word "spirit". Science has been born in the West and is overpowering the East. Here, too, it is almost like a disease; at least, I felt it so when I wandered through the dirty streets of Calcutta, where it is scarcely possible to breathe, an unimaginable dirt is everywhere. There are little shops with boards signalling in huge letters "scientific laundry", "scientific druggist". "scientific soap", everything is scientific, not because it has anything to do with what we in the West understand as scientific – but because the word is so fascinating.

O, let us become true scientists again. Let us lift up that priceless jewel from the dust into which it has fallen; let us bring life into the dead, and as we add vitamins to the food that it may nourish the body, so let us strive to find the way from Natural Science to a true Spiritual Science.

Chapter XIV.
EXPERIMENTS WITH ANIMALS TO STUDY THE INFLUENCE OF "SMALLEST ENTITIES"

Experiments with animals carried out to find the decisive proof that "fertilizers" even used in small amounts are harmful:

The whole problem concerned with the use of artificial fertilizers seems to be comprised in one great question. Is it possible to prove scientifically that they are really harmful? The present current slogan is: **the amount of poison used, is so small that it cannot harm the human being who consumes the food.**

Therefore it was our next task to find out if this assumption is true, that a small quantity of poison is harmless.

We could not make these experiments with human beings; on the other hand experiments with plants would also be insufficient to solve the problem of whether small amounts of poisonous substances cause diseases. We had to try with animals. We chose white mice for this purpose. We started breeding the mice necessary for a large-scale experiment. The plan was to have at least three different series at the same time, besides the untreated stock.

The first series of mice were to be treated with potencies of **silver nitrate.** The reason for choosing this substance was, that we had already made many hundreds of plant experiments with **silver nitrate** and therefore had a profound knowledge of the effect these potencies produce on growing plants.

The second series were to be treated with some well-known and much-used chemical preparation containing **quicksilver,** and here we chose the preparation sold to many farmers in Germany under the name of **Uspulum.**

The third series were to be treated with a **copper salt.** We used **copper sulphate,** for we also had a rich experience of this salt in plant experiments.

Mice treated with Silver Nitrate

The whole experiment lasted for three years, from 1929-32. We began with the 4th potency (equivalent to a dilution of 1 gram of silver nitrate in 10, 000 c.c. water), it did not seem wise to start with a lower potency. Then we went on until the 30th potency. The animals were kept in large wire-meshed cages with sawdust at the bottom. We started the experiment with one pair (male and female) each mouse having the same weight. It was not easy to fulfil this condition. A small margin of difference was allowed. The average weight for the whole series had been fixed at 15 grams, and there was no mouse weighing less than 14.5 grams, or more than 15.5 grams. We selected young, healthy animals which had not yet been paired.

Treatment:

The mice were fed exclusively on wheat soaked beforehand in the respective potency of silver nitrate, and they had also the potency of silver nitrate to drink.

After a fortnight we again noted the weight of each mouse, and compared these notes with our first statement. It was clearly seen, that some mice lost weight, some gained and some remained steady. Still the differences were not sufficient to justify a definite judgment.

We are fully aware that it would be ideal to give a full description of each mouse, to enumerate every detail; or at least to produce a chart for each mouse showing the progress of weight, for the female mouse the different litters; the weight before and after the litter. It is quite impossible to do this here. Perhaps we shall have the opportunity of writing a book on this subject only, where all the details could be given. We must apologize for the lack of these in the present publication, which can only summarize the results obtained.

After a few weeks the weight of the silver series showed definite differences, and the graph obtained was almost identical with the graphs we usually get in taking the measurements of an experiment with plants. The minimum of weight occurred at the 11th potency. After about two months this pair of mice died. Not a single mouse in all the other experiments had died until then. We thought that perhaps this happened by chance; that we had not chosen a healthy pair right from the beginning; therefore we started with a fresh pair, selected with utmost care. This experiment started on 20th December, and, strange to say, the mice died on 24th February, after eight weeks' treatment with the 11th potency of silver nitrate. Still, not a single mouse had died in the other two series. This time it looked much less like mere chance. We repeated the experiment again on the 23rd March; the mice died on 7th July. This experiment lasted nearly four months. The mice had paired, but *there was no litter.*

We repeated the experiment on the 20th July. The female mouse died before the litter on the 16th August, and a few days later the male died.

Once more we repeated the experiment on the 28th August and the mice died on the 23rd November.

It seemed useless to go on with this potency, which proved fatal in such a short time. The 11th potency means a dilution of 1/100,000,000,000 = 1 gram of silver nitrate dissolved in 100 million litres water. Here it is hardly possible to speak about "substances"; we really are entitled to speak of **forces.** The higher we dilute a substance, the stronger the force liberated. The substance gets less and less – the force becomes stronger and stronger.

On the other hand, the mice treated with the 18th potency of silver nitrate increased in weight from the initial 15 grams to 43 grams (male and female).

The female mouse had the first litter on 16th July with 7 mice
The female mouse had the second on 12th Sept. with 7 mice
The female mouse had the third on 12th Nov. with 11 mice

We kept the second generation apart, and later on the third, and first, and went on with the treatment.

A short time after we started these experiments we noted that all the mice treated with silver nitrate disliked the light. They became highly **sensitive towards any kind of light.** The other two series did not show this phenomenon.

In the course of a year a certain number of the mice showed signs of diseases:

tumours on the neck, sometimes along the spine; most of the mice started to get fistulae.

We include the photos of some cases, which are typical for the effect silver nitrate produces, even in higher potencies.

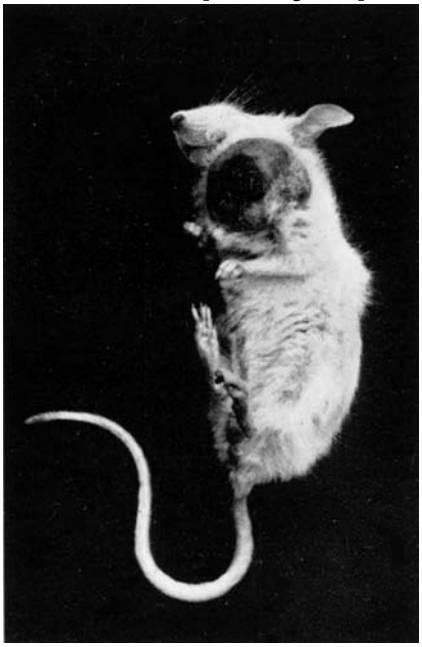
No. 1 a. 7th potency. Tumour begins to form on the throat:

Fig. 76 Mouse treated with 7th potency silver nitrate

No. 1 b. The same mouse half a year later. The tumour is considerably bigger. The mouse is very sensitive, does not like to be touched. Appetite good.

Fig. 77 Mouse treated with 7th potency of silver nitrate

No. 1 c. Post-mortem photo. A second tumour has developed along the spine.



No. 1 d. Post-mortem photo. Another view of the same mouse.

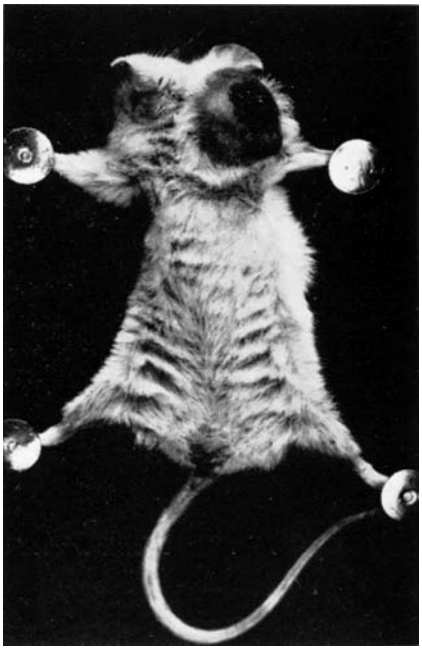


Fig. 78 Mouse treated with 7th potency of silver nitrate Fig. 79

No. 2. 19th potency. Post-mortem photo. A larger tumour on the throat and a putrid fistula on the back had developed.

Fig. 80 Mouse treated with 19th potency of silver nitrate

No. 3. 23rd potency. Post-mortem photo. Putrid fistula on the belly.

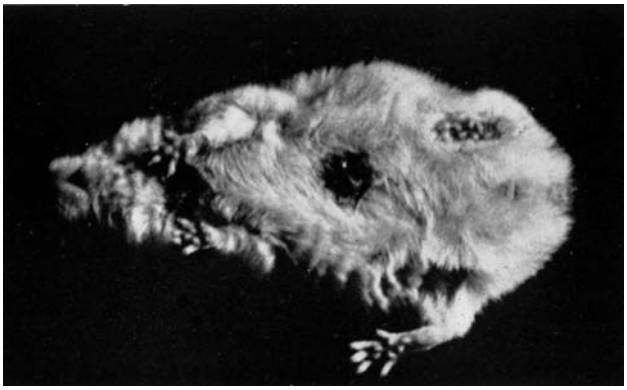


Fig. 81 Mouse treated with 19th potency of silver nitrate

No. 4. 29th potency. A tumour in the sexual region is visible.

Fig. 82 Mouse, treated with 23rd potency of silver nitrate

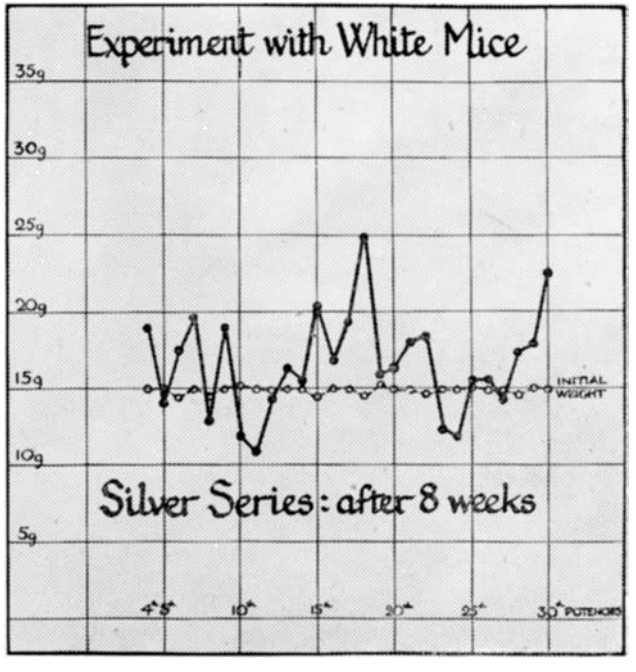


Fig. 83 Graph obtained for the weight of the series treated with silver nitrate after 8 weeks from the start

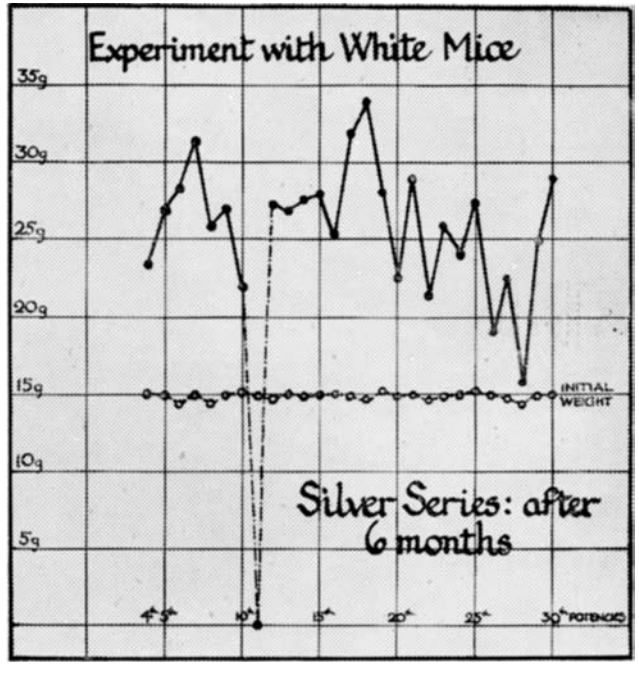


Fig. 84 Graph obtained for the weight of the series treated with silver nitrate 6 months after the start

No similar diseases occurred in the other two series, nor did any of the untreated mice show tumours or fistulae.

Figures referring to the above graphs. Weight of mice

	Starting the experiment with silver nitrate	8 weeks later	6 months later
Potency	grams	grams	grams
4th	15.0	19.0	23.5
5th	15.0	14.0	27.0
6th	14.5	17.5	28.5
7th	15.0	19.7	31.0
8th	14.5	13.0	26.0
9th	15.0	19.0	27.0
10th	15.3	12.0	22.0
11th	15.0	**11.0**	--
12th	14.8	14.5	27.5
13th	15.0	16.5	27.0
14th	14.5	15.5	27.5
45th	15.0	20.5	28.0
16th	15.0	17.0	25.5
17th	15.0	19.5	32.0
18th	14.5	**25.0**	**34.0**
19th	15.3	16.0	28.0
20th	15.0	16.5	22.5
21st	15.0	18.0	29.0
22nd	14.8	18.5	21.5
23rd	15.0	12.5	26.0
24th	15.0	12.0	24.0
25th	15.3	15.5	27.5
26th	15.0	15.5	19.0
27th	14.8	14.5	22.5
28th	14.5	17.5	**16.0**
29th	15.0	18.0	25.0
30th	15.0	22.5	29.0

The experiment with **copper** sulphate was started with the 3rd potency, and it seems astonishing that the mice throve quite well on this low potency. After eight weeks they had increased from 15 grams to 18 grams, and after half a year's treatment their weight had further increased to 25.5 grams.

It is interesting to study the charts referring to these weights:

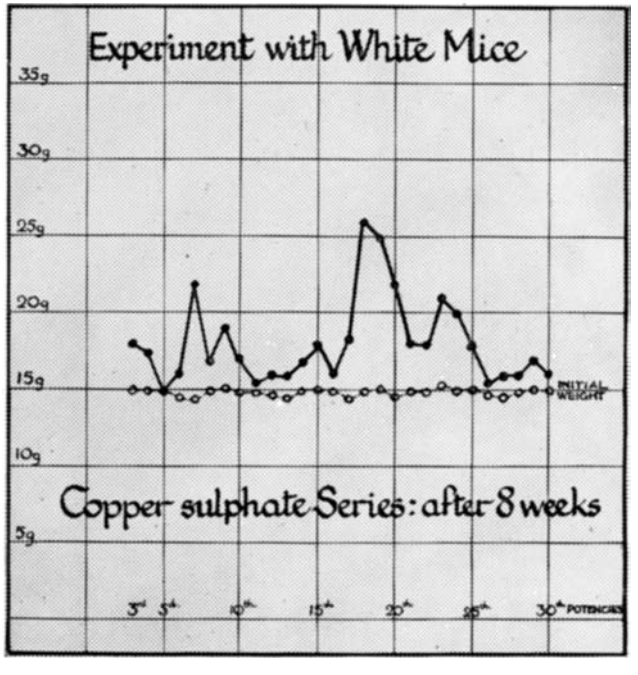


Fig. 85 Graph obtained for the weight of the series treated with copper sulphate 8 weeks after the start

The first maximum is at the 7th potency, the second at the 18th. The minima are not quite clearly marked.

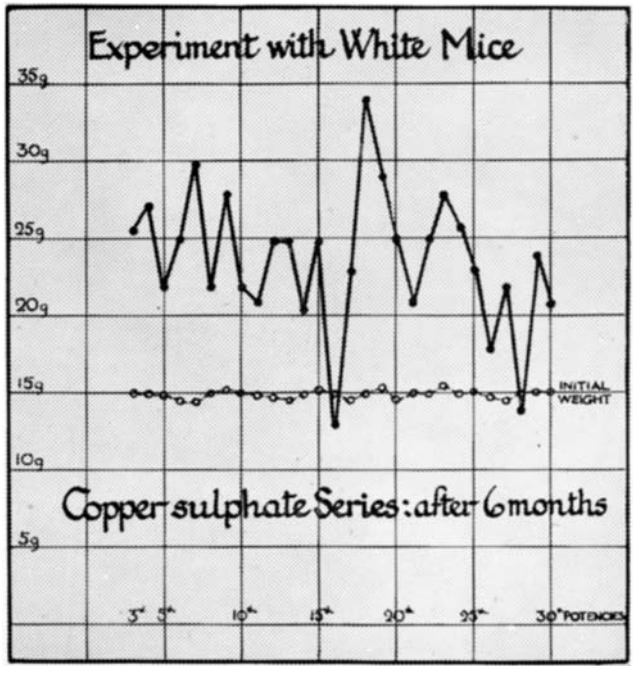


Fig. 86 Graph obtained for the weight of the series treated with copper sulphate 6 months after the start

We find again the 7th and the 18th potencies considerably increased in weight. The first minimum at the 16th and the second at the 28th potency.

The series with **silver nitrate** kept nearly the same points. The two maxima 7th and 18th potencies; the two minima: 11th and 28th potencies.

The exact figures for the weight follow:

Weight of the mice

Before starting the Experiment		*After 8 weeks treatment with copper sulphate*	*After 6 months treatment*
Potency	*grams*	*grams*	*grams*
3rd	15.0	18.0	25.6
4th	15.0	17.5	27.0
5th	15.0	15.0	22.0
6th	14.5	16.0	25.0
7th	14.5	**22.0**	**30.5**
8th	15.0	17.0	22.5
9th	15.3	19.0	28.0
10th	15.0	17.0	22.0
11th	15.0	15.5	21.0
12th	14.8	16.0	25.0
13th	14.5	16.0	25.0
14th	15.0	17.0	20.5
15th	15.3	18.0	25.0
16th	15.0	16.0	**13.0**
17th	14.5	18.5	23.5
18th	15.0	**26.0**	**34.0**
19th	15.2	25.0	29.0
20th	14.5	22.0	25.5
21st	15.0	18.0	21.0
22nd	15.0	18.0	25.0
23rd	15.5	21.0	28.0
24th	15.0	20.0	26.0
25th	15.0	18.0	23.5
26th	14.8	15.5	18.0
27th	14.5	16.0	22.0
28th	15.0	16.0	**14.0**
29th	15.0	17.0	24.0
30th	15.0	16.0	21.0

The mice were quite lively, but their reproduction was not so abundant as that of the silver series. The average litter was 5 mice, very rarely was there a litter with 6 or even 7 (the silver mice rarely had less than 7, and more often 9 and even 11 young ones in a litter). After sometime these mice behaved very curiously: they were always scratching their ears. They scratched so vigorously that after some time their ears were fringed. The ears of white mice are very tender organs, pink, and nearly transparent. They must have itched terribly. Entering the room containing all those cages

of mice, you could tell from some distance: this is a mouse treated with copper because it is scratching its ear. This phenomenon only occurred in the copper series.

Some potencies developed a tumour inside the ear (the 9th, 17th, 23rd and 26th potencies). We tried hard to get a photo, but these mice would not keep quiet. Even putting them underneath a glass cloche did not help much. Fig. 87 may give some idea of the condition of their ears. We recognize the inflammation in the dark colour and the tumour inside the ear.

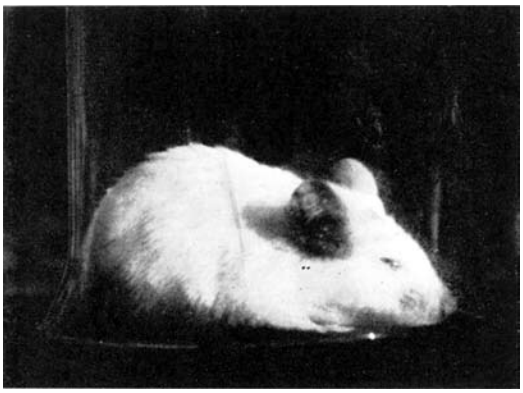


Fig. 87 Mouse treated with the 23rd potency of copper sulphate. Tumour inside the ear

We kept the mice, of course, until they died, and then investigated the condition of the inner organs. We give a short description of a few potencies typical for the whole series.

In Fig. 88 we reproduce the organs of a mouse treated with the 3rd potency. At the top of the photo are the lungs and heart; then both kidneys; underneath is the liver, with the gall bladder, and at the bottom the spleen.

Fig. 88 Inner organs of mouse treated with 3rd potency of copper sulphate

The **gall bladder is enormous.** Normally the gall bladder of a mouse is only a tiny ball, like the head of a pin; here the gall bladder is as big as a pea. With the help of a magnifying glass it can easily be seen that the structure of the bladder is not normal; it is hardened and we even find some nodules.

Fig. 89 shows the difference in size between a normal gall bladder and this degenerated one.

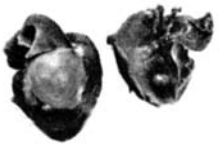


Fig. 89
Left – Liver with enlarged gall bladder Right – Liver with normal gall bladder

7th potency: If we look at the graph, we have a kind of maximum weight represented – but weight does not exactly mean health. It is just the same with a huge cabbage, produced with artificial manure; it does not mean that its food value is excellent, and that it is good for people to eat these vegetables forced to grow excessively large.

Fig. 90 Post-mortem photo of mouse treated with 7th potency copper sulphate

Opening the body, we find that the tender skin which covers the intestines is infiltrated by parasites and the organs most damaged arc the kidneys. They are both enormously enlarged. Fig. 92 A shows a section through one of these organs to demonstrate the complete destruction of its substance.

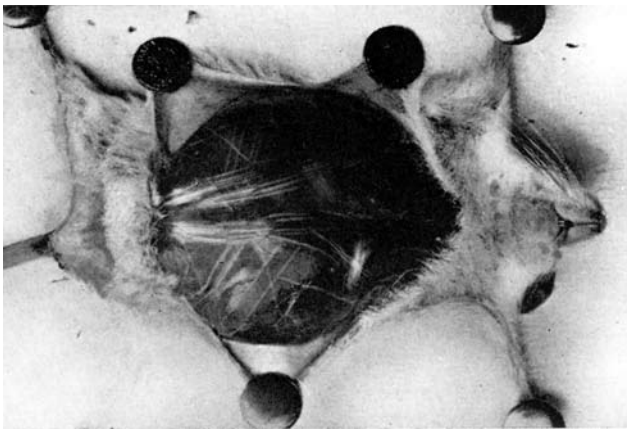


Fig. 91 Opened body of 7th potency mouse

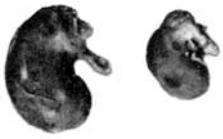


Fig. 92 The enormously enlarged kidneys

Fig. 92 A Section through this organ

Fig. 93 Liver and enlarged gall bladder. Mouse treated with the 11th potency of copper sulphate

Fig. 94 Inner organs of mouse treated with the 16th potency of copper sulphate

16th potency: Nearly all the inner organs had suffered badly under the influence of this potency; the heart was damaged, the lungs partly inflamed and interwoven with hard nodules. The kidneys were normal, the liver enlarged, and the gall bladder enormous. Fig. 94 shows that the gall bladder nearly fills the whole space of the liver. It is still larger than the one we found in the mouse treated with the 3rd potency. The **spleen,** is also enlarged.

21st potency. This is an example of the shrinking of the kidneys. Sometimes both kidneys are shrunk; in this case only one shows this phenomenon exceedingly clearly.

Fig. 95 Mouse treated with the 21st potency of copper sulphate

Another example of shrunken kidneys is demonstrated in Fig. 96. This mouse had been treated with the 23rd potency.

Fig. 96 Mouse treated with the 23rd potency copper sulphate, shrunken kidneys

Fig. 97 Mouse treated with the 24th potency copper sulphate, enlarged gall bladder

Fig. 98 Mouse treated with the 25th potency copper sulphate, enlarged gall bladder and tumours in the liver

It is remarkable to note, that **either** there is the **enlarged gall bladder, or the Shrunken kidneys.** These two diseases never occur together.

These experiments seem to us quite convincing as to what happens if copper, even in a high potency, is taken for some time. On page 134 we gave a resume about the views expressed by medical men concerning copper poisoning in human beings. The consequences are: liver shrinkage, gall-stones. Labourers in a vineyard who sprinkled the copper sulphate on the plants have kidney shrinkage and eczema behind the ears. The animals show pathological changes in the liver and kidneys, the cells are destroyed in these organs, according to the **accumulation of copper.**

Here science is wrong. It is not necessarily an accumulation of copper. It is not the substance in large quantities which causes the greatest harm – it is the "smallest entities" which we have been taught to neglect as harmless, which produce those terrible effects, because **the forces are stronger than the substances.** They are imprisoned in the solid matter, and the more we dilute, the more we free the hidden forces. We cannot see them, we cannot touch them, we cannot put them on the scales – but they act with deadly certainty.

We live in the age when everybody likes to speak about the "radiating forces", about "waves", "cosmic waves" and so on – and nobody doubts these – then why not acknowledge the fact that potentized substances are liberated forces, which can be studied as exactly as all other phenomena? If this fact were once understood then it should not be necessary to say much more about all those artificial manures, all those poisons we use so freely in farms and gardens, because the **quantity** of the poison used, **is so small.**

It is a crime against Mankind.

Experiment with Mice treated with "Uspulum"

Uspulum is used very frequently. It contains a certain amount of quicksilver and many farmers dip their grains in the dilution prescribed by the chemist, to protect the grains from diseases.

This experiment also started with the **3rd** potency. Looking at the graph representing the weight of the mice treated with the different potencies, we find the first maximum arises earlier than with the silver or copper series. It occurs as early as the 5th potency; after eight weeks' treatment as well as after six months' treatment, we find this potency indicated as a maximum in weight.

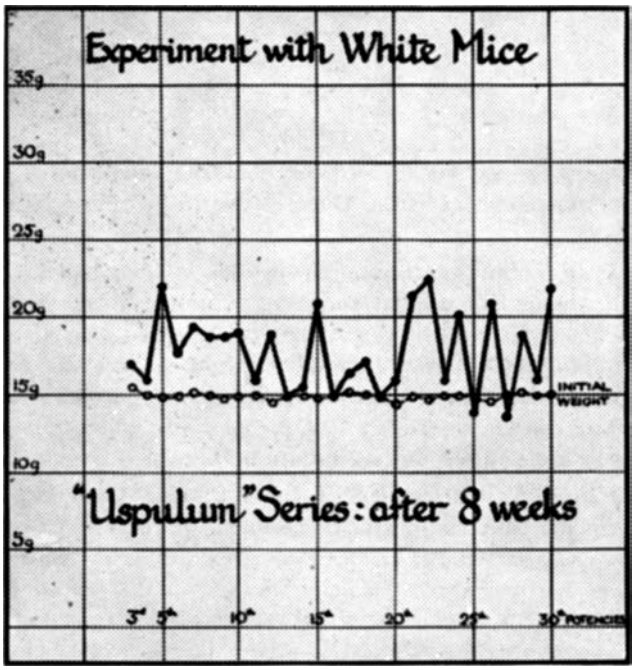


Fig. 99 Graph obtained for the weight of the series treated with Uspulum 8 weeks after the- start

The second graph obtained after six months' treatment is clearer than the first one. The second maximum is the 17th potency (silver and copper had the 18th potency), but there is even a third, still higher maximum: the 28th potency. Perhaps we could also mark three minima: the 6th, 16th and 27th potencies. A certain inversion takes place. For instance, silver and copper have the 25th potency as a minimum, and here is a maximum.

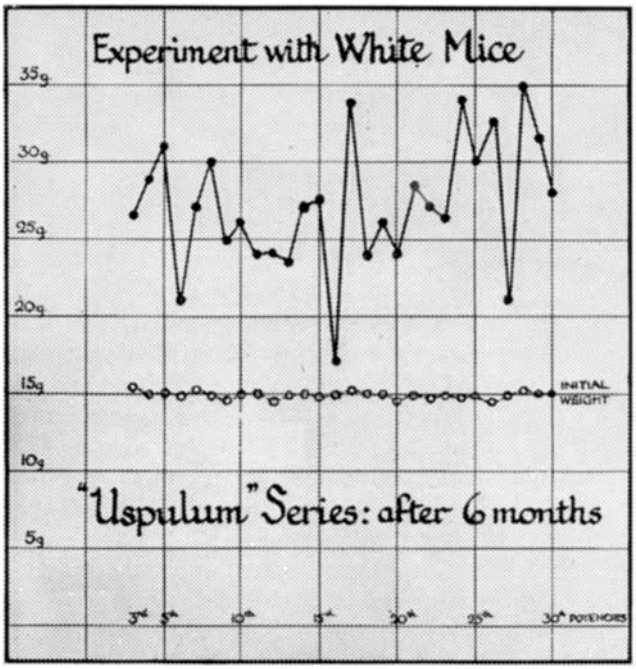


Fig. 100 Graph obtained for the weight of the series treated with Uspulum 6 months after the start

Figures referring to the above two graphs:

Weight of Mice

Starting the experiment with Uspulum		*8 weeks later*	*6 months later*
Potency	*grams*	*grams*	*grams*
3rd	15.5	17.0	26.5
4th	15.0	16.0	29.0
5th	15.0	**22.0**	**31.0**
6th	15.0	17.5	**21.0**
7th	15.3	19.5	27.0
8th	15.0	18-8	30.0
9th	14.7	18.8	25.0
10th	15.0	19.0	26.0
11th	15.0	16.0	24.0
12th	14.5	19.0	24.0
13th	15.0	15.0	23.5
14th	15.0	15.3	27.0
15th	14.8	21.0	27.5

Starting the experiment with Uspulum		*8 weeks later*	*6 months later*
Potency	*grams*	*grams*	*grams*
16th	15.0 ,	15.0	**17.0**
17th	15.3	16.5	**34.0**
18th	15.0	17.2	24.0
19th	15.0	15.0	26.0
20th	14.5	16.0	24.0
21st	15.0	21.5	28.5
22nd	14.7	22.5	27.0
23rd	15.0	16.0	26.5
24th	15.0	20.3	34.0
25th	14.7	14.0	30.0
26th	14.5	21.0	32.5
27th	15.0	13.5	**21.0**
28th	15.2	19.0	**35.0**
29th	15.0	16.0	31.5
30th	15.0	21.8	28.0

The quicksilver series produced quite different phenomena if we compare them with the two other series. The quicksilver affected at first the **skin** and the hair. The mice began to lose the hair on their heads, then along the spine, and later also on the abdomen. This began to be noticeable very early. Later, after eight to 9 months had elapsed, some mice started an inflammation of the eyes, at first only in one eye (usually the right), and then in both; then the cornea was affected, and later still they became blind. It **was** very sad to look at all those little creatures which had lost their eyesight. About 75% of all the mice in this series became **blind.**

Reproduction was very poor. Litters were small, sometimes there were only two young ones. Very often the young mice starved to death, because the female had not enough milk to feed them. So we did not succeed in getting a second generation from all the potencies and had no third generation. The young mice very soon developed inflammation of the eyes We give a few examples out of this series:

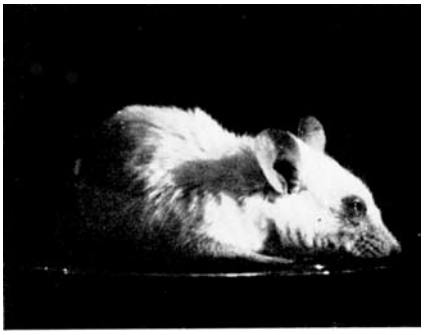


Fig. 101 Mouse treated with the 7th potency of Uspulum

Fig. 102 Mouse treated with the 20th potency of Uspulum

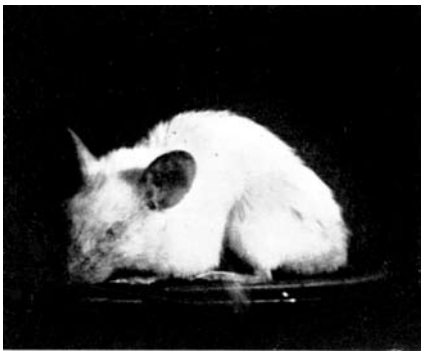


Fig. 103 Mouse treated with the 25th potency of Uspulum

The inner organs which were damaged by the various potencies were the **lungs** and the liver. But most injury was undoubtedly to the lungs. 80% of the whole series treated with quicksilver showed some lung damage; at least there was inflammation of the lungs, but a large number had severe degenerative processes in the lungs. We illustrate our statement with a few examples.

Fig. 104 Treated with the 5th potency, liver and spleen enlarged, hard, entirely degenerated

Fig. 105. Treated with 13th potency, tumour in the lungs, spleen slightly enlarged

Fig. 106 Treated with the 25th potency, tumours in the lungs

Fig. 107 Treated with the 28th potency, liver and spleen degeneration

The study of these various poisons used abundantly in agriculture and their effects on animals, even in high potencies, is a sad chapter.

The so-called "**homoeopathic**" school of medium his been in existence for many years There are thousands of doctors who are convinced that remedies are more effective if used in high potencies. But they are not considered scientific. Homoeopathy has not yet been able to give ample proof that it is d. "scientific system". On the other hand, it is accepted as scientifically justifiable to say:

"Poisons like quicksilver, or lead, or arsenic, are not at all dangerous in small quantities. All those deadly poisons we use as fertilizers-, or sprays are perfectly harmless, because the quantity is so small". That is scientific.

In every field of life science meets with the problem of "smallest entities". The real trouble is, that our present science with its marvellous achievements, is more or less only a science of the inorganic world. We must again emphasize the need for a Science of Life. This science will have to deal with forces, with the life force, and has therefore to go a step further, from matter to force.

We sincerely hope that this book about the **Agriculture of To-morrow** will make clear to the public and the scientists, that a science of life has to be created for the sake of mankind. What we are doing now in agriculture will bear fruit later on. Our children and children's children will have to suffer for our mistakes.

Studying the effect of those minute quantities of substances which are abundantly used by farmers and gardeners in their effort to get bigger crops, or to prevent plant diseases, we come to the next problem: **Nutrition** and **Vitamins.**

Chapter XV.
NUTRITION AND AGRICULTURE.

The whole sphere of **agriculture** is closely connected with the problems of nutrition. For a long time, great stress has been laid upon the **substantial** part of the foodstuffs. The nutritive value has been considered as equivalent to the matter of the foodstuffs. This is just the same as the prevailing idea that in farming and gardening the most important part is to feed the plant, and that everything depends on the substances which are in the soil. Many of the agricultural methods of the last decades have been born out of this idea – that one has to feed the plant, and that certain **substances** have to be introduced into plant life. The plant has been looked upon as the result of the various substances with which the plants have been fed.

Plants have a quite different source of nourishment from that of animals. The plant takes the greatest part of its nourishment from the air, not from the soil. The plant assimilates, transforms, the carbonic acid of the atmosphere, so that the carbon substance of the plant is formed. From the soil the plant takes the salts and a few other substances, connected with animal manure. But the greatest amount, especially everything that has to do with the plant-nature itself, with the green pigment of the leaves, all this is taken from the air. We owe the oxygen of our atmosphere, the possibility of our breathing, entirely to the plant kingdom. Our oxygen atmosphere has only arisen because whole vegetations were submerged when the land subsided, and buried beneath a mass of sand, to be transformed – millions of years ago – into carbon. Carbon has been deposited in the depths of the earth and the oxygen has been freed.

We can say that we owe our oxygen atmosphere on the one hand, to the plants, and on the other hand to another substance – **calcium.** Calcium absorbs carbonic acid, so that we do not suffocate.

We have already pointed out that the plant is built up only to a very small degree from those substances which it takes out of the soil; plants take their food largely from the surrounding atmosphere, the air. We have also pointed out, that the process of taking carbonic acid out of the air, is closely connected with **light.** So we can say that a large proportion of the substances which feed the plants is light, and all that is connected with it that is streaming into the plants. The process of assimilation and of taking foodstuffs out of the air, with the help of chlorophyll, may indicate, that there are two factors collaborating together. The one factor consists in the material, the substances, and the either factor is all that comes into the plant with the light out of the universe. We have to look at plants in such a way that we learn to recognize these two different processes. On the one hand there is the seed embedded in the soil, developing its roots, taking in the salts from the soil. On the other hand the plant is sprouting towards the light. Two opposite forces are acting, the one coming from the earth, the other coming from the cosmos. From the earth come the substances, from the cosmos the forces. Studying plant life we shall always have to reckon with these two entirely different forces; and many things which seem so problematic to-day, have become problematic because we do not like to acknowledge that there are two different forces acting in plant life: those connected with the earth, with the forces of gravitation, the more material forces; and those which are streaming in from the universe, having light as their foremost representative. Of course there are many other things streaming in from the universe with light, chemical and other manifold influences.

In respect of the **food-value** of the plant, much more depends on these cosmic forces, on how the plant is building up its whole life process, than on the substances themselves, because this fact also determines how the plant absorbs the food.

We can never assess the values of human food merely from scientific considerations. If, for instance, a person's food does not contain any living vegetable matter, or if it makes no appeal to his sense of taste, and so does not interest him, or give him pleasure and thereby affect him psychologically – then the food does not really nourish him. The food may have been prescribed for him scientifically, but it will not nourish. It is similar with plants. They do not take from the soil all the substances we have put into it, unless we first take care that they have the requisite strength to absorb them.

The forces which enable the plant to take up the various substances, are different from the substances themselves.

Experiments have been made by growing plants in a variety of nutritive solutions, to find how much of their ingredients the plant needs. Our whole method of manuring, of using artificial fertilizers, has been built up upon the idea, that everything depends on the substances used. Nevertheless, the question of the vitamins arises. Something of the fresh and living plant must be present. We need the **forces** and not the substances. Certain forces are needed by man which will make him assimilate the food. He requires living substances so that he may transform them, destroy them, according to his individual strength. The foreign life, entering the human body, acts upon him in such a way, as to stimulate the digestive process.

There is no method existing up to the present, which would enable us to find the food value of agricultural products.

To-day, farmers are only anxious to increase their crops with the help of fertilizers. The aim is to produce more material, more substance. But nobody has tried to discover what happens if these products are then used for human food. It is because we only think of matter that no one has ever undertaken to look for food-value in other qualities.

For instance, **electricity** may be used to increase our crops. Electric light, or electric heat make the plants grow more quickly, and bigger crops result. Certainly that is of economic value. But we should think what it means when the plant is forced to grow much more quickly, to ripen much earlier, so that whereas in the natural course the plants accomplish their flowering and fruiting and ripening once, with the help of electricity they will now complete this process twice in the same period. They are emancipated from the seasons, emancipated from the sun. We do not consider such subtle differences, because we are convinced beforehand that what streams in from the universe can easily be compensated for by earthly forces. We believe that electricity can do the same as the sun. But in reality these are two entirely different forces. Electricity is more connected with the depths of the earth. The forces of electricity – if we could not isolate them – would always stream into the soil. They belong to the earth. If we use electricity, we use the counterpart of light. From an external point of view, light is present in both cases; only these two lights are entirely different in origin and effect.

If we were to experiment with plants grown under the influence of electric light, we should find that they have a different food value. The real food value depends upon forces streaming in from the universe, bringing **life** to the plant; electricity always acts in a contrary manner – against the normal processes of life.

It was stated that it is possible with the help of ultra-violet rays to get three harvests in one year. If cabbages have been grown in a third of the usual time needed for a cabbage to grow, then something must have been lost – namely something of its quality. The plant can only develop its full life-process, if it is placed rightly in the rhythm of the year and of the seasons. Nothing can take the place of this. Flour, for instance, treated with ultra-violet rays, can never be a substitute for the true living quality of the natural product, which is by no means merely the summation of its chemical constituents. It consists of the forces of life.

Therefore, in farming we must take into consideration that the plants are not only the result of earthly forces, but also of all those forces which emanate from the whole cosmos. Here we are at the very beginning of a new science. Chemical elements are not present only in the foodstuffs, they also radiate everywhere, and are present in the light. Their are nearly as many different kinds of light-radiations as there are substances. In **rickets** light is of the utmost importance. If babies are in dark rooms their bones cannot be formed in the right way. It is just the formation of the bones, indeed the formation of the whole body, that depends not so much on the substances themselves, but on the influences which stream in from the cosmos. In the periphery **silica** is highly active. It acts on the skin, in the hair, in the sense organs, where silica is even present as substance. But the substance itself is not the important part; what is really important is **silica-metabolism.** This is a living process and through this process form is created.'

It is just the same with the earth as a whole. The earth has an immense silica mantle. Silica is always on the periphery; even in microscopic small objects, in cells, we find it in the outer membranes. In Nature we see silica forming the most beautiful crystals. Rock crystals are perfectly transparent; but considered as substance, silica is inactive. Therefore silica has not been taken into serious consideration for a long time, although it has been used in homoeopathy and becomes active in homoeopathic preparations; only then it is no longer present in substantial quantities. Silica plays a great part in the plant kingdom, where it acts as a kind of collector for all those forces which stream in from the cosmos.

On the other hand if we study **calcium**, we find that this substance always withdraws into the inner parts of the body. Lime provides the human being with his skeleton. Compared with silica, lime is a more earthly substance. It is a great pity that the modern science of chemistry makes no such subtle discriminations between earthly and cosmic substances. We find both on earth, and we find both in the stars; therefore, we tend to bring them both to the same level. But they have quite opposite effects, according to the realm from which they are derived.

In Chapter VI when dealing with the influence of light and darkness on plant growth, we pointed out already that silica plays such an important part in plant life, and that it mediates a certain **light-metabolism.** If silica is present in the soil, then the plants can make better use of the light beneath the surface of the soil. It is much more important for their healthy growth that there should be a certain amount of silica in the soil (which helps the plant to collect all the cosmic forces) than to add artificial fertilizers, which they cannot assimilate – just as the nourishment which is reckoned out for human beings according to its caloric value does not really nourish them.

It is necessary to have agricultural methods which will ensure that the agricultural products are still real plants. To-day we sometimes get vegetables which still look real enough, but they no longer carry cosmic forces within them.

The question is – how can we find the right method in farming and gardening, so that the plants retain their original cosmic qualities instead of growing huge cabbages filled with chemical fertilizers only? How is it possible to have agricultural methods which take into consideration that plants are only real plants if we do not rob them of those subtle forces which stream into them from the whole universe? We cannot substitute ultra-violet or other rays for the life-processes.

It is very generally supposed that the active part of cow manure consists in the different mineral salts which it contains, and that therefore it is possible to substitute mineral salts for cow manure. But it is essential for the plant to be in inter-relation with animal life. The **nitrogen** contained in animal albumen plays an important part. Nitrogen is a substance which is found in the atmosphere in large quantities – but there it is usually inactive. Under certain circumstances this natural nitrogen may become active. For instance, in the animal body it is immensely active, always in movement, always entering into chemical compounds, or if there is a thunderstorm, and the lightning flashes, the rain which pours down contains nitrogenous salts. So what usually takes place as nitrogen activity in the animal body, now happens as a cosmic process. Hence rainwater acts as a manure for the plants.

If we add animal manure to the soil, we complete a certain circulation between the plant and animal kingdoms. The plant takes its nourishment out of the soil from below, but gets its life-forces from the substances which have passed through the animal metabolism.

Thus there is always an interplay between plants and animals. The leguminous plants take the nitrogen directly from the soil. We use them again for green manuring – they have certain qualities which we may compare with those of animals.

Above, the animal eats the plant; and below, the plants eat the animal manure. That is a circulatory process. We cannot make a substitute for this living circulation by separating the salts. We say the plants use potassium nitrate. But take only potassium nitrate and feed the plant with it. Does the plant like to absorb the pure potassium nitrate? Does it develop the same appetite for the mineral salt as it develops for the whole living process?

It is important for plant life to come into contact with animal manure. What is manure for the chemist? A conglomerate of many substances. For the chemist only those substances are pure which have undergone chemical analysis. Everything else is a compound. This is, of course, correct for the chemist who makes experiments in test-tubes. But in the realm of Nature we must say that such a thing as "manure" is, in the organic world, much simpler than the different constituents which we separate out of the manure by chemical analysis.

We say that albumen is the most complicated substance, and it certainly is so according to chemical analysis. We can try to build it up, we can come very close to it – but we can never make it. Albumen is that substance where chemical science comes to an end. There are **forces** in the albumen, which escape chemical analysis. But from the point of view of "life", albumen is the most simple substance. It is everywhere in protoplasm and biologically entirely simple. If we kill it, if we begin to analyse it, then we are faced with something enormously complicated.

Is not manure an entity in itself, for which we can never create a substitute with an artificial conglomerate?

We can never substitute for the food value obtainable from the living product, the summation of its chemical constituents.

Chapter XVI.
WHAT ARE THE VITAMINS?

The modern theory of nutrition entered a new phase of development when, about twenty years ago, the so-called vitamins were discovered. We cannot assume that every reader of this book is thoroughly acquainted with these facts, so we include a few introductory remarks about vitamins.

There were certain diseases which had puzzled scientists for a long time. It was not quite clear whether these diseases were caused by some specific bacteria, or whether there were other causes, for instance, a one-sided nutrition. People who for a long period had nothing but meat to eat, especially tinned meat, developed **scurvy.** The symptoms of this disease are well known: a general weakness of the muscles, haemorrhage, general emaciation, the skin becomes pale and loose, a great decline of vitality sets in, which may become fatal. This extremely dangerous illness can quickly be cured, if the patients have even small quantities of fresh vegetables, or fruit juices, lemon juice or orange juice. But it is essential that the juices should be fresh.

Another **similar** illness occurs especially in Malay, the Dutch East Indian Colonies and in China. The symptoms of this disease, the so-called Beri-Beri (or Japanese "Kakke") are general exhaustion, decaying muscles, swelling of the limbs, and complete lack of resistance in the organism. Paralysis due to the decay of the muscles sets in. The Beri-Beri disease attacks people who live more or less exclusively on polished rice. Experiments were carried out, a number of poisons being fed on polished rice, while others had rice with the skin. All those fed upon polished rice contracted Beri-Beri disease. They could be cured with a decoction of the rice skin. So it became clear that this disease was entirely due to certain nutritive substances in the skin of the rice, or very close underneath the skin, which are lost through the polishing process.

Again, a similar thing happens in districts where the population consumes large quantities of maize. If the maize is skinned, the **pellagra** disease occurs. The symptoms of this disease are also very characteristic. At first there are slight attacks during spring and autumn when people show awkwardness in their movements, and have a characteristic way of walking. Then they begin to complain of headaches, dizziness, sleeplessness, weakness and neuralgia. Later they lose their appetite, sometimes they have a strong aversion for the accustomed food, then again they have a ravenous appetite. The tongue becomes inflamed, excessive salivation sets in; the patients are thirsty, they have stomach-ache and often diarrhoea. It is clear that there is complete disorder in the metabolic system. This disease can also be cured by giving maize which has not been skinned.

After some time it was stated that this applies to all cereals, because just underneath the skin substances are concealed which are vital for nourishment.

The same applies to the skin of oranges and lemons, etc. Each living organism isolates itself from the surrounding world with a skin or shell; just there, where the life-process is gradually entering the mineralized part on the periphery, something is deposited which contains an enormous intensity of vital forces, on the borderline between the organic and inorganic.

Starting from this point, many experiments have ben carried out to isolate these substances, because our modern physiological chemistry is always seeking for the causes of these particular effects. Even to-day we are still inclined to attribute the effect of a remedy belonging to the plant

or animal kingdom entirely to the sum of its chemical constituents. It is sought to find the essential thing which is responsible for the cure in a single chemical substance. The effect must, as it were, cling to some material particle.

Everything has been tried in order to discover these substances, and to isolate them from the various plants which show these specific properties. It is strange that sometimes only the most minute amounts are sufficient to restore health. **The quantities are really so small that one can realize how strong is the contrast between the substantial effect of foodstuffs and this remedial effect.** Those substances which it was hoped to isolate, are called **vitamins.**

Many years have passed, and therefore we can review some of the results of these endeavours More and more vitamins have been found. But there are four especially important ones: vitamins A, B, C, and D.

The attempt has been made, therefore, to isolate from fresh plants, specially from green leaves and fruit juices, something which still contains the essential properties of these fresh vegetables or juices. This has been called Vitamin C and is able to cure scurvy.

What is hidden in the skin of all cereals, lemons and oranges, has been called Vitamin B. It cures Beri-Beri disease.

Another illness is rickets. It is well-known that this illness also has something to do with nutrition. It occurs when the skeleton is being formed, when the bony system begins to develop in the first and second years of childhood. Rickets occur within a certain age limit and during this period substances contained in animal fats help, for instance cod liver oil, or other things containing phosphorus. In these is the Vitamin D.

In animal fats, in butter, milk, and in the yolk of eggs, there is a substance which is especially connected with growth and with the warmth-process in the human organism. If this substance is not present, growth cannot develop in the right way and the warmth of the organism is disturbed. That substance is Vitamin A. It has a great resistance to heat. Usually the vitamins are very sensitive to heat. If we heat foodstuff more than 70 °C the vitamins are destroyed. But vitamin A is not so sensitive to the higher degrees of warmth. Recently more and more vitamin-like substances have been found. It is not quite correct to say "substances". It is not possible to produce such a substance, in the same sense in which we usually speak of producing chemical substances.

If we produce a salt or some other chemical substance we know perfectly well what we have created. We know that it has a certain melting point, boils at a certain temperature, has a certain form when it crystallizes. There are qualities we can define. It is not so with the vitamins. We can try to extract them from animal fats or green plants. But in doing this the life of the organism is lost. Isolation of these vitamins has been tried, but it has never been possible to produce a vitamin in the same sense that we can produce other chemical substances. **We should say therefore, that the vitamins are not substances.**

The theory of the **calories** rightly starts from substances, since these play a part in nutrition. But in the effect of the vitamins we have something which is in direct contrast to the material effect. Once a comparison was made between food taken directly from the plant kingdom, and the same thing artificially produced in the laboratory. One may take the same quantity of substance and it may have exactly the same caloric value, but if a human being eats the chemical product it has no food value at all, and after some time the symptoms of scurvy appear. The same happens if we eat tinned conserves which no longer possess those vitamins. If we plan our nourishment

thinking that the nutritive value is equal to the sum of the various chemical ingredients, then it happens that after some time we are compelled to add the real nutritive values in small amounts in the form of vitamins.

Chapter XVII.
FERMENTS.

A similar phenomenon is found in another sphere of physiology. When digestion takes place, various digestive juices must be produced by the organism. We know that there is hydrochloric acid in the stomach and another substance we call **Pepsin,** a ferment. The question arises: "What is a ferment?" Just as we had to ask "What is a vitamin?" so we have now to ask, **what is a ferment?** A ferment is only present in very small quantities in something that is living, and has the capacity of starting certain reactions, for instance, the process of fermentation of yeast. Wherever yeast is added, fermentation begins. For many, many years scientists could not make up their minds whether fermentation is something material, or an effect of life. A great French scientist held the opinion that it is an effect of life, others had different opinions, that it is only something material.

To-day we can make Pepsin. We take some gastric juice and add alcohol. A deposit is produced, which is more or less albumen. The deposit is dried and purified, and at last becomes a white powder. This white powder is nothing more than a somewhat transformed, dried and purified juice from the stomach. Of course we must be careful not to change it too much in preparation, or it becomes inactive. We can dissolve some of this white powder in water, add one drop of hydrochloric acid and some of the albumen of an egg. The albumen dissolves, it becomes "digested", although there is no stomach there. The digestive **power of the stomach has been isolated.** That is the ferment which is called Pepsin. But that too is a substance which we cannot quite understand chemically. It is the living function of the stomach which still clings to its material bearer.

Everywhere in nature we find such ferments. The pure chemical substances are absolutely dead, and they can be isolated. The ferments are not such chemical substances, they are always connected with some living organism; plants, animals, or the human being. There are nearly as many ferments as there are substances. There is one branch of science which is only dedicated to the study of fermentation. Nothing would function in a living organism without the collaboration of the ferments with the different substances. For instance in the stomach, the ferment acts with hydrochloric acid.

In the pancreas there is again another ferment active: **Tripsin.** Whenever we have a chemical substance, we know exactly what this substance is, we know all its qualities, etc., but a ferment is nothing else than an expression for a specific function of life. Everything arises out of the collaboration of such life-functions with chemical substances. That is very similar to the vitamin-problem.

Everywhere in the inner organism there are ferments; and just as the summation of all the chemical substances represents the material body, the summation of all the ferments represents the unity of all the life processes.

In Pepsin there is still a part of the stomach which is able to digest, although not so strongly as the stomach itself can digest. It has retained part of the living organic functions. Each organ, each juice has another function.

The vitamins are similar. We cannot produce them as we can other chemical substances. The vitamins that we can buy are similar to ferments. Something has been extracted very carefully from the life-process of plants. The effect can be increased according to the quantity, condensing what is distributed in Nature among many plants. There is a different life-process in the leaves, fruits or roots. But the vitamins are treated as other chemical substances, and we want to feed human beings with them. Some time ago everything was estimated according to its caloric value; now the same thing is done with the vitamin-contents, which are introduced everywhere as foods. They are regarded as material substances.

Another scientific opinion is, that vitamins are identical with specific radiations. It has been found that in treating milk, or butter, or flour with ultra-violet rays, similar effects are produced as with vitamins. Some people think it is not necessary to have vitamins and that foodstuffs treated with ultra-violet rays may be substituted for them. In recent years many food preparations have been sold to the public which have been so treated. For instance, one such preparation was called "Vigantol". At first everybody recommended it, then it was violently rejected. It was found that vitamins could also act as poison. Because it is assumed that vitamin is a substance plus ultra-violet radiation, it is a great mistake to substitute chemical matter treated with ultra-violet rays for the living plant organism. If to-day one reads an advertisement of vitamin preparations, one does not know what one is really buying. It may be only some substance treated with ultra-violet rays. Although it is introduced to the public as food – in reality it has nothing whatsoever to do with human nourishment.

Sometimes such "foods" may at first cause a certain increase in vitality, and later on the opposite thing occurs – sclerosis. The bones become brittle etc. The same is the case with radium or X-rays. They have an effect on the life-process – but it is very difficult to find the right quantity to administer. That is easy to understand. We may know how much to administer of a substance; it is much more difficult to find the right quantity of a radiating energy – it may act in a manner quite contrary to our intentions. We are not working with life-processes in such a case, but with radiations – something emanating from decaying substances.

Science has discovered vitamins – but this has not helped towards an understanding of the vital processes in Nature. It has only led to the isolating of these vitamins; to considering them equivalent to other substances; or to considering them as substances plus radiations. It would not matter so much, if we did not feed mankind with these dangerous preparations.

It is astonishing how many things the public can obtain which are dangerous to handle. Everybody is convinced that radium or ultra-violet rays are excellent things Many people possess lamps emitting ultra-violet rays and they regularly treat all their children with them. More and more people are buying these lamps, but do they really know what force they are using?

In buying salt – one is not always sure that it does not contain iodine. Iodine is a very effective substance in the hands of a doctor – but should it really used freely by the public?

We buy foods, and are told they have been treated with ultra-violet rays, and that should mean that they are rich in vitamins. Are they really richer in life forces? Or is the contrary the case?

Ultra-violet rays have nothing whatsoever to do with original vitamins – the life-force hidden in the fresh plants.

We need a new science which will be able to tell us about substances. If we are convinced that matter is the only important entity, and neglect the wide realm of forces, we make serious mistakes.

Take, for instance, a substance like citric acid. Citric acid is found in Nature in lemons, 7-9 %, and in other fruits in a lesser degree (red currants, bilberries, gooseberries, sugar beet, sugar cane, etc.). Citric acid can also be bought from a chemist in the form of white crystals. It might be made from lemon juice, but it could also be made synthetically from aceton, or with the help of some bacteria. Lemonade can be made either from a real lemon, or from a few crystals of citric acid. Is there any difference between these two lemonades? Both contain citric acid – but the one comes directly from the fresh fruit, the other is extracted by chemical methods from fruits, or built up synthetically. The one may contain the so-called vitamins, the other not. They have nearly the same taste, provided the same degree of acidity is in both lemonades. We need to have a good sense of taste to be perfectly sure which of the two juices is the fresh lemon juice. How can we find out if there is really a difference between these two forms of citric acid?

Chapter XVIII.
CAPILLARY DYNAMOLYSYS*

In the Biological Institute at the Goetheanum (Stuttgart) we have developed a specific method of research, which enables us to find the various forces hidden in substances, just as "Vitamins" are hidden in fresh vegetables or fruit. We call our method: Capillary Dynamolysis. It is based on the same principles as Capillary Analysis. Since we cannot presume that every reader is familiar with this scientific method, we will give a few historical facts.

The phenomenon of capillary attraction was mentioned in the fifteenth century by Leonardo da Vinci, the great painter, who was at the same time a great architect, sculptor, musician, and scientist!

The first scientist who studied this phenomenon was Niccolo Aggiunti (1600-1635) Professor of Mathematics at the University of Pisa. He found out that liquids rise in capillary vessels.

Much later, in the second half of the 17th century capillary attraction was studied more thoroughly by a member of the Academia del Cimento, Giovanni Alfonso Boielli. Still later we find publications by Laplace (1805), Th. Young (1805), Gay Lussac (1808), Gauss (1830), Quinke (1858), Mendelejeff (1860), Röntgen (1878) and many other well-known scientists.

Capillary attraction is the process of a liquid rising in filter paper or any porous medium (e.g., a liquid rising in a sponge, or sugar; paraffin rising in the wick of a lamp). We find this phenomenon prevailing everywhere in nature. The soil takes in water through capillary attraction, the sap of plants or trees rises in all the vessels through capillary attraction, and in animals and human beings the blood circulates through capillary vessels.

* Circumstances compelled me to make an advance print of this chapter in 1943. For the sake of completeness we reprint it in this book, and add some more experiments.

† Histoire des sciences math, en Italie, III 54.

It has been found, that each substance has its own rising limit. Water rises in filter paper to a certain height. Alcohol has another rising limit. Plant juices, according to their viscosity, again have various rising limits (of course, the temperature and humidity of the air has always to be taken into consideration). It is not possible to go into details about the phenomenon of capillary attraction in this book. We merely want to mention it for the sake of explaining our method of Capillary Dynamolysis. This is a new term which we are introducing, and it may seem complicated, but, in reality, it is quite simple if one understands the meaning.

Well known is the method of capillary analysis. Owing to the fact, that each substance has its own rising limit, it is possible to analyse mixtures with the help of the phenomenon of capillary attraction. If we study, for instance, the careful investigations earned out by Friedrich Goppelsröder (Capillar-analyse, Basel 1901), we find that he uses for a capillary medium strips of filter paper. The juice of the roots of a grass is extracted with alcohol. The filter paper is dipped in that extract, and the liquid begins to rise. After some time the limit of rising is reached, and when the paper gets dry it is possible to distinguish differently coloured zones. Then Goppelsröder takes the measurement for each zone and ultimately describes the result obtained:

2.5	colourless
0.5	yellow
2.3	colourless
0.37	brown
0.4	light brown
0.4	nearly colourless
0.1	brown
0.15	light brown highshine
0.1	brown
2.35	brown highshine
0.35	brown
Total 9.52	

Mixtures of colours, or urine may be treated in a similar way. The different substances present in the urine are deposited in different zones in the filter paper according to their rising capacity. It is, of course, very interesting to make these tests, and many useful details may be found. But in all these tests we have to deal with a purely physico-chemical analysis. The scientist only looks for the substances in using capillary analysis.

We use the same principle that liquids rise in filter paper, but we want to study the forces acting in the various substances. We want to look behind the veil of matter.

We will try to explain what we mean, with an experiment carried out with lemonade:

(a) with the juice of a fresh lemon
(b) with citric acid dissolved in water.
Both liquids contain the same amount of citric acid.

In a glass dish containing juice (a) and in another glass dish containing juice (b) we dip filter paper folded cylindrically. The width of the filter paper is 10 inches, the height 14 inches. Both juices rise and reach approximately the same rising limit. The paper remains colourless, the border lines are scarcely to be seen. Looking at these two filter paper tests, we cannot discriminate

between the fresh lemon juice and the citric acid solution. The only possible difference to be found in this test would be in the eventual difference of the rising height.

If we taste juice (a) and the solution of citric acid (b), our sense of taste can also scarcely differentiate between them, and still we know that there exists an enormous difference: the one is derived from a fresh fruit containing the precious vitamins, and the other is made in a laboratory and can originate from various sources.

We proceed to the second half of our experiment. After the filter paper is quite dry, we add a metal salt = nitrate of silver in a solution of 1%. The experiment has to be made in daylight. There must be sunshine, but not too bright. The citric acid reduces silver nitrate and is helped in this process by light. The filter paper which has been penetrated with the real lemon juice begins, after 10 minutes, to get yellow. The silver nitrate is rising and in the rising process beautiful leaf-like structures appear, as if they were engraved with a pencil in the paper.

The second experiment where the filter paper has been dipped in the citric acid solution, shows that the silver nitrate rises in the same manner – but no yellow colour appears. After a long time we may find that there are some forms engraved there also; the colour is greyish-black. The formation is weak in comparison with the other test, which now bears a brilliantly yellow-brown coloured picture. The photos reproduced here in Figs. 108 and 109 convey only to a small extent the beauty of the original experiment.

These two pictures reveal something of the inner force, the inner life of these two lemonades. Of course we cannot sufficiently describe the pictures with figures; it is no use to measure or to count; either we realize the living plant force in the one, and the lack of this force in the other, or we do not realize it. We must learn to read these experiments. It is a very real script which Nature places before our eyes.

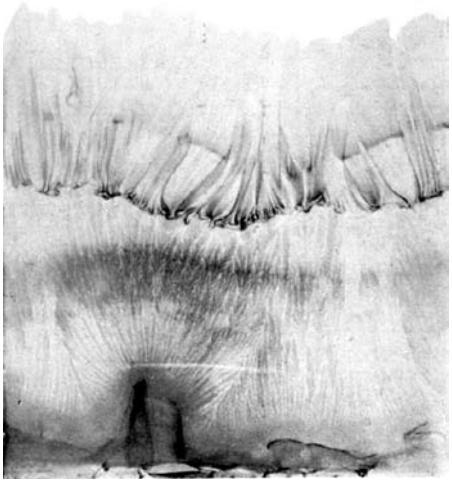


Fig. 108 Experiment with citric acid followed by 1% silver nitrate

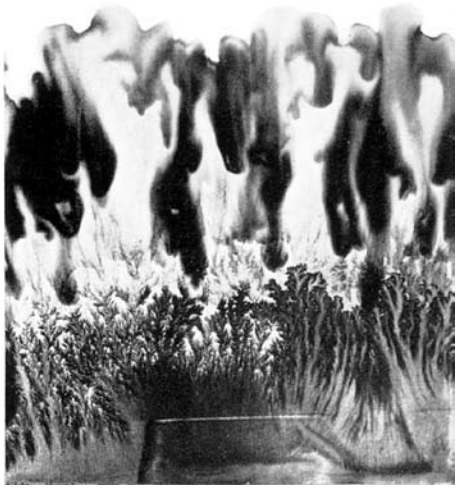


Fig. 109 Experiment with lemon juice followed by 1% silver nitrate

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 transferred to England. It took a long time until we found the solution for this seemingly simple problem: to study the formative forces in plants with the help of a filter paper test. Dr. Steiner gave us a list indicating various plants with which this test should be carried out, and we hope that some day it will be possible to publish these experiments; they are not yet completed. Even after twenty years' work we do not feel that this task is completed.

If we take only the plant juices we shall never find the formative forces hidden in the various plants. After having studied thoroughly foe years the formative forces hidden in inorganic matter, i.e., in various metal salts and how these metal salts arc connected with cosmic forces, we were able to find the solution to the problem given us the study of the plant formative forces. We had to **combine the action of the metal salts with the specific action of the various plant juices.**

In 1922 we had also started experiments with human and animal excretions on the same lines, at first having in mind the question: can we trace an influence of the moon on these excretions? Thus these experiments started even earlier than our well-known researches about the "Influence of the Moon on Plant Growth".

In 1923 we proceeded along the lines of our research work connected with plant juices, to search also for the hidden formative forces in animal and human excretions. With this part of our research work we will deal in the next chapter.

The method of Capillary Dynamolysis can be varied in many ways, according to the substance which has to be investigated. We do not only use nitrate of silver; other metal salts can and have to be used. Thus we can find if the various juices or cordials we buy in bottles with attractive labels, telling us how good and how refreshing they are, really contain life forces, or are only dead mineral salts, coloured and flavoured.

We would like to give some examples to show the effectiveness of our method. Some years ago a Dutch friend offered us two fruit juices to try: Rhubarb juice and Tomato juice. They had been prepared by a special method and were supposed to contain all the vitamins of the fresh plants. We made the first capillary test with fresh rhubarb juice and the preserved one. (Fig. 110 and Fig. 111.)

The fresh juice is slightly pink, the border line is clearly visible, the rising limit is 12.5 cm. The preserved juice is clear yellow, the rising limit is 11.5 cm., still there is not much difference between the two pictures before adding the metal salt After the addition of the silver nitrate we notice again a vivid yellow brown colouration in the picture forming itself together with the fresh rhubarb juice and a pale yellow and grey colour in the preserved juice.

The finished experiment reveals a strong radiating force in the fresh rhubarb juice (Fig. 112) which is completely lacking in the preserved specimen (Fig. 113).

Many control experiments are carried out with various other metal salts, but we are unable to reproduce them all. For example the experiment with gold chloride is very instructive for the rhubarb juice.

The beauty in experiments carried out with gold chloride is due to the manifold colouration in the first place the preserved juice produces a rather dull picture, more or less uniform slightly

yellow, with horizontal purple lines. The fresh juice is entirely worked through with mauve and purple shades, and shows a similar radiating force permeating the whole picture (Figs. 114 and 115)

Fig. 110 Rhubarb Juice preserved

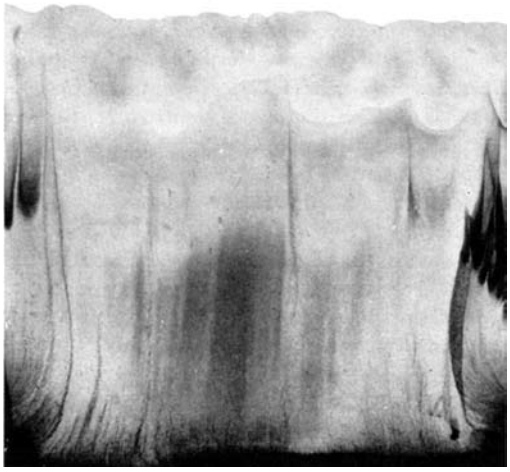


Fig. 112 Preserved Rhubarb Juice followed by 1% silver nitrate

Fig. 111 Rhubarb Juice fresh

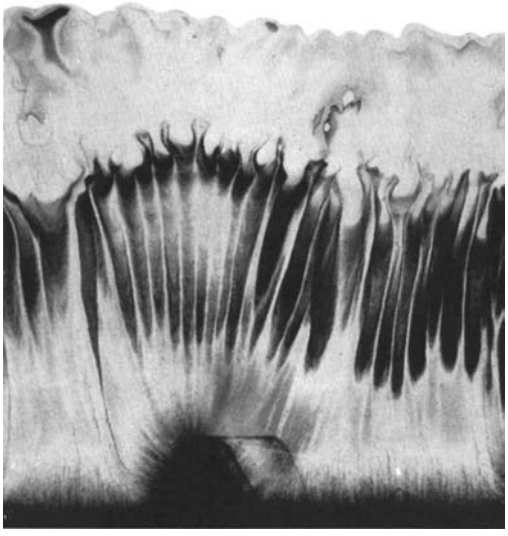


Fig. 113 Fresh Rhubarb Juice followed by 1% silver nitrate

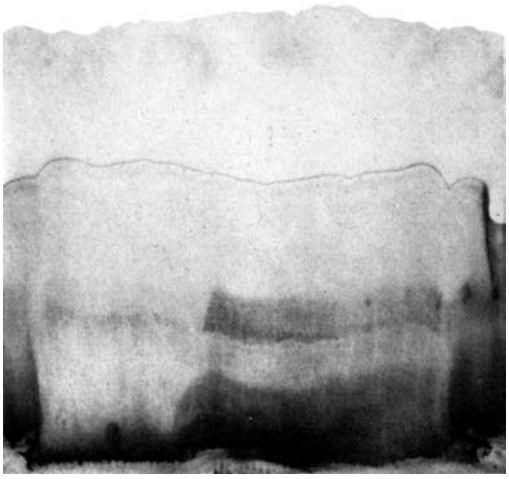


Fig. 114 Preserved Rhubarb Juice followed by 1% gold chloride

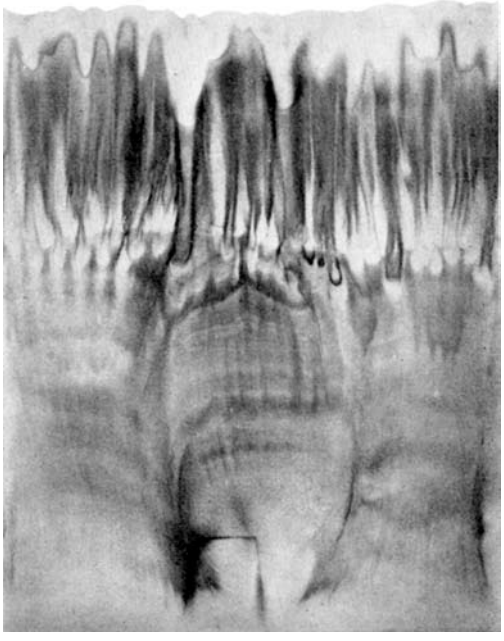


Fig. 115 Fresh Rhubarb Juice followed by 1% gold chloride

The same carried out with fresh and preserved tomato juice is also very interesting. (Figs. 116 and 117).

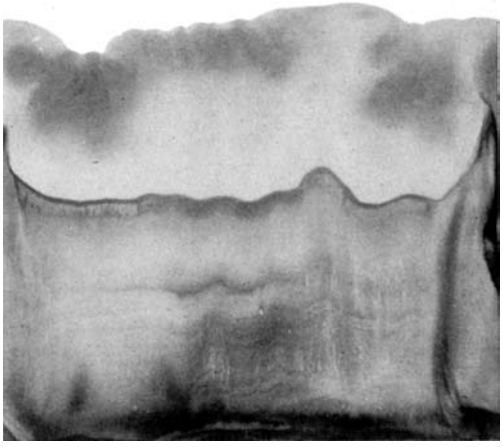


Fig. 116 Preserved Tomato Juice followed by 1% gold chloride

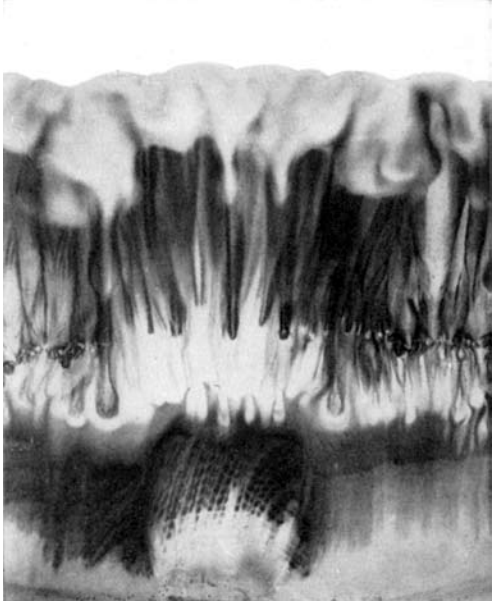


Fig. 117 Fresh Tomato Juice followed by 1% gold chloride

It is easily seen, that the fresh tomato juice is full of life, and the preserved one nearly lifeless. Furthermore, if we compare the test of the prepared rhubarb juice with the test of the prepared tomato juice there is a great similarity between these two pictures. It is our opinion that the similarity is due to the method used for preserving. It is very likely that the preservation has been carried out with electricity.

Even more striking is the contrast between the tests where we use an addition of silver nitrate.

Fig. 118 Preserved Tomato Juice followed by 1% silver nitrate

Fig. 119 Fresh Tomato Juice followed by 1% silver nitrate

Silver nitrate brings out the full development of the forces working in the fresh tomato juice. It is a coarse and undisciplined force which is revealed in these experiments. That force has been killed

with the preserving. The juice still tastes like tomatoes; only to a schooled sense of taste, there is a certain quality behind it, which makes it dull. Of course there is still the question left open: should the tomato fruit be used so freely as a "refreshing drink"? Does the human organism agree with it? Tomato cocktails are more and more frequently asked for. Very often these cocktails are made from the fresh fruit, so that the full strength of this plant enters the human organism.

Some years ago a scientist made experiments with rats. They were fed with tomatoes, and, after some time, ulcers appeared. The scientist spoke of carcinoma or sarcoma. A short time after the contradiction came from the business man. Of course it cannot have been cancer, it must have been something entirely harmless, because tomatoes are so refreshing, and an excellent food.

It would be worth while to investigate further into this matter.

Chapter XIX.
Practical Application of Capillary Dynamolysis in testing various methods of fruit preservation

Some years ago we made experiments in trying out the various possibilities of Capillary Dynamolysis. A great business concern which specializes in apple and orange juices sent us some bottles containing apple juice treated with various methods of preservation. The bottles were numbered 1, 2, 3, and we were to tell with our method, if there were any differences in the three bottles, and which one we found the best.

At first we tasted the various juices and made notes of our observations. Then we invited friends, adults and children, to taste and give us their opinions. All of them decided that number "3" did not taste at all pleasant; number "2" was good, and number "1" was between the two others.

After this we started with the Capillary Dynamolysis using additionally metal salts: silver nitrate, gold chloride and others. For objective control purposes we also used the juice freshly pressed from an apple. The result is represented in the four following photos.

The pictures obtained by our method reflected what we had tasted. The juice we liked best, had preserved much from the original apple forces. The fresh juice is more penetrated with life, the forms are like flaming torches, and the colours of the original lively yellow-brown.

Bottle "2" has, in a certain way, the same forming tendency, only it looks somehow frozen, finer, thinner, a little less lively and the colours are not so glowing.

Bottle "1" shows, in the lower part of the test, some leaf-like structures, but the rest of the picture is rather heavy and chaotic. If we compare this with the fresh juice, it seems that some harm is done to the life force of the apple.

Bottle "3" is perfectly destroyed as far as life is concerned. At the bottom of the picture we recognize that some effort has been made to form leaves, but all the rest is overpowered by a formless mass of brown and brown-green spots. The original formative force of the apple is destroyed. There is no life left in this juice. It cannot be recommended as a beverage, from our point of view.

We sent our report to the manager of the concern in question and asked for information about the three methods of preservation used by them.

He replied that bottle "1" had been preserved by heat, bottle "2" with cold (it was a special new process, freezing out the water content, which could not be explained in detail to us, being kept as a business secret). Bottle "3" had been preserved by electricity.

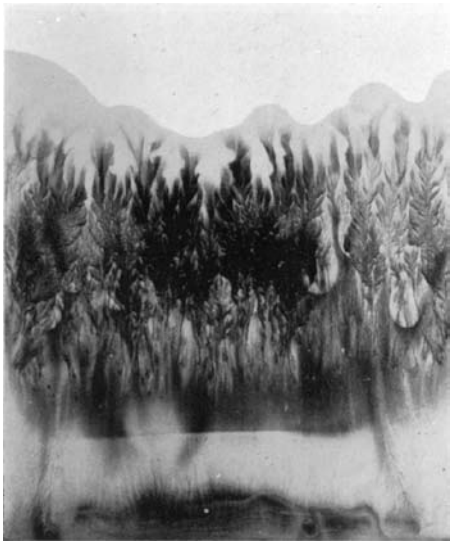
The chemist of this concern rejected our opinion that the juice treated with electricity was the worst. He thought from a scientific point of view, it must be the best. Neither heat nor cold would influence the juice so homogeneously. The electric current passes through, and the whole juice is sterilized. It may be sterilized, we do not doubt this. We also do not doubt that the electric current really touches every atom of the juice, and transforms it in a homogeneous way. Only it also kills the life force completely.

We are convinced that this method of Capillary Dynamolysis is able to solve many problems concerning the value of food. But it can only be handled by an expert who has been trained for years in the various fields connected with this subtle test.

It is impossible to give in this short introduction to a new sphere of scientific research, a complete picture of the manifold problems which may find solutions. We must limit ourselves here to a few examples. More will be found in the various chapters of the book dealing with agricultural problems, and much of our research work will have to wait for later publication.

Another interesting problem arises, for instance, if we have to use a substance for remedial purposes. Can we replace the natural substance with the synthetical one? This leads to the next chapter.

Fig 120. Juice of fresh Apple followed by 1% silver nitrate



Fig, 121 Bottle "2" which we found best. Followed by 1% silver nitrate

Fig 122 Bottle "1" which we found next best. Followed by 1% silver nitrate

Fig 122 Bottle "3" which did not taste pleasant.. Followed by 1% silver nitrate

Chapter XX.
Practical Application of Capillary Dynamolysis:
The difference between "natural" formic acid and "synthetic" formic acid

We have studied this problem thoroughly, but can give here only one example.

In the case of lemonade with fresh lemon juice, or citric acid, we have seen, that the fresh juice contains life forces, while the pure citric acid is more or less devoid of life forces.

We proceed from plants to animal excretions. Formic acid is excreted by ants naturally, or it can be made artificially in the chemical laboratory. Both liquids are formic acid; both have the same chemical formula, only the one is chemically "pure" the other is "natural". It was not easy to find the right kind of experiment for these substances, but after some time we succeeded.

Silver nitrate and gold chloride cannot be used for this test in the same way as for plant juices. Of course we can let formic acid rise in the filter paper and then, later on, add the various metal salt solutions, only the result is not characteristic enough to enable us to form a clear judgment.

The best method for formic acid is to use a mixture of silver nitrate and iron sulphate. These two metal salts are used in a concentration of 1%, mixed in equal quantities and filter paper is dipped in. The result is fascinating; 10-15 minutes after starting the experiment, the formation of tiny black spots sets in. These spots grow to little arrows which seem to fly in from various directions of space. Fig. 124 represents this type of experiment.

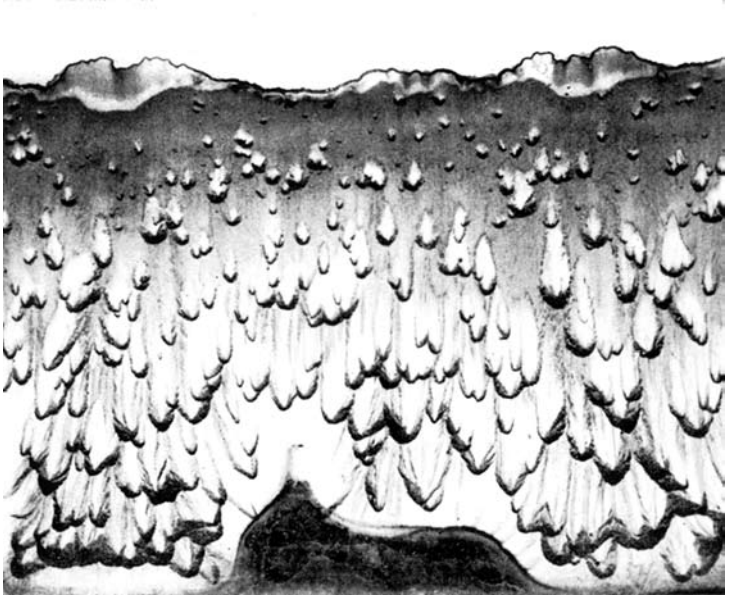


Fig. 124 1% Silver nitrate and 1% iron sulphate mixed in equal quantities

This mixture is suitable to reveal the hidden formative force of formic acid. We add a few drops of natural formic acid, or synthetic formic acid, and study the respective changes. Figs. 125, 126, 127, 128 represent such an experiment carried out in 1930. The percentage of acid in both cases was exactly the same.

The addition of the "natural" formic acid, changes in a most powerful way, the forming process ordinarily present in a mixture of silver nitrate and iron sulphate. The arrow like forms get much more pointed. To a certain extent they look rounded off, if these two metal salts act together, and they definitely change to a sharp pointed structure whenever we add natural formic acid. Another characteristic change we notice in studying the original experiment, is the colouration. Silver nitrate and iron sulphate give a greyish-black picture; the added natural formic acid permeates the picture with a warm yellowish-brown glow.

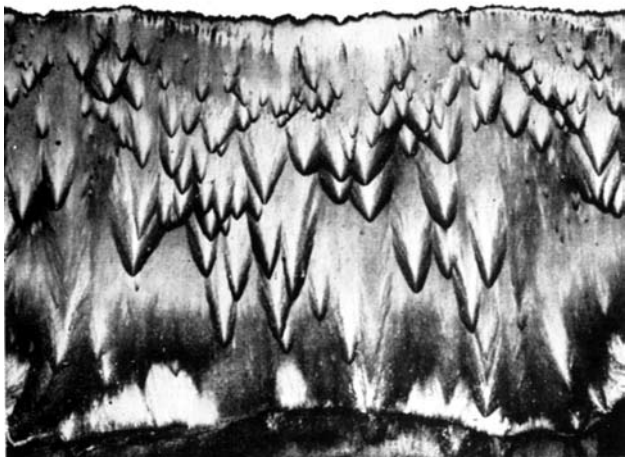


Fig. 125 1% silver nitrate and 1% iron sulphate plus natural formic acid (alcoholic extract)

Now we turn to the experiment containing "synthetic" formic acid (Fig. 126) and must state, that the rich forming process of the two metal salts has been subdued by the synthetic formic acid. There are considerably less forms, the clearness is changed into a veiled picture of a more uniform greyish-black. The few arrow like formations which pierce through that veil, are likewise changed to a more pointed structure. We get, quite definitely the impression, in comparing the three experiments (Figs. 124, 125, 126) that the natural formic acid has enhanced a certain form process, and made it look more "lively", the synthetic formic acid, has subdued it, and nearly destroyed the characteristic silver-iron formation.

The "pure" chemical substance has nothing of the life process in itself which the animal excretion possesses so abundantly.

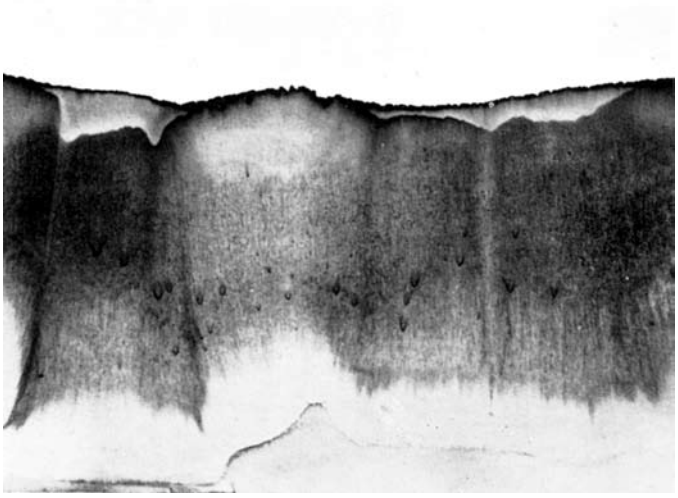


Fig. 126 1% silver nitrate and 1% iron sulphate plus synthetic formic acid

These experiments can teach us to think twice before we substitute the purest chemical matter for fresh substances from the animal – or plant kingdom. Also remedial effects in synthetic substances must be accordingly different.

Many more examples could be given. We can only add one more in this connection. Fig. 125 represents an experiment with natural formic acid containing alcohol. Is there any difference between an alcoholic extract of formic acid and an extract where simply distilled water has been used?

The comparison between Figs. 127 and 128 gives a similar result to the comparison between Figs. 125 and 126. The natural formic acid enhances the formation, the synthetic one subdues it. Now we must compare Fig. 127 with Fig. 128 to discriminate between the alcoholic extraction and the extraction with distilled water. We hope it is possible for the reader who has only the prints and not the beautiful originals before his eyes to notice the great difference which exists between these two extracts. The watery extract is certainly more active than the alcoholic one. The single forms are still more pointed and represent clear triangles. The colour of the original was even more lively yellow-brown than that of the alcoholic extraction.

There is no doubt that the watery extract is more powerful than the alcoholic one.

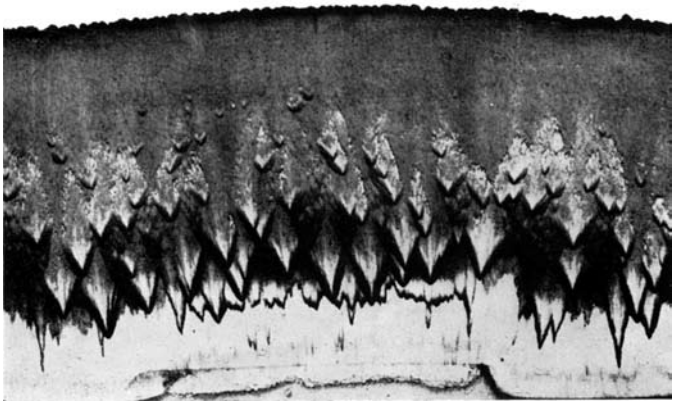


Fig. 127 1% silver nitrate and 1% iron sulphate plus natural formic acid extracted with distilled water

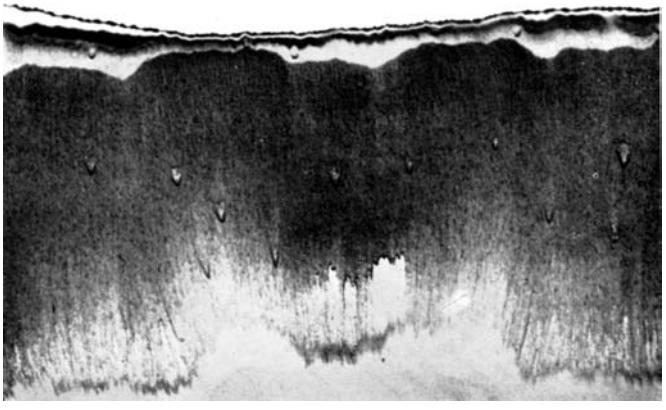


Fig. 128 1% silver nitrate and 1% iron sulphate plus synthetic formic acid

Each experiment is, to a certain extent, the endeavour to find an answer to a question we bear in mind. In a way, the answer given, puts at the same time a new question before our searching minds, which urges us on continuously, to strive for a real understanding of nature. So we arrive at the next question: How long may we keep these various extracts so that they still contain their strength, their value as is remedy, for instance?

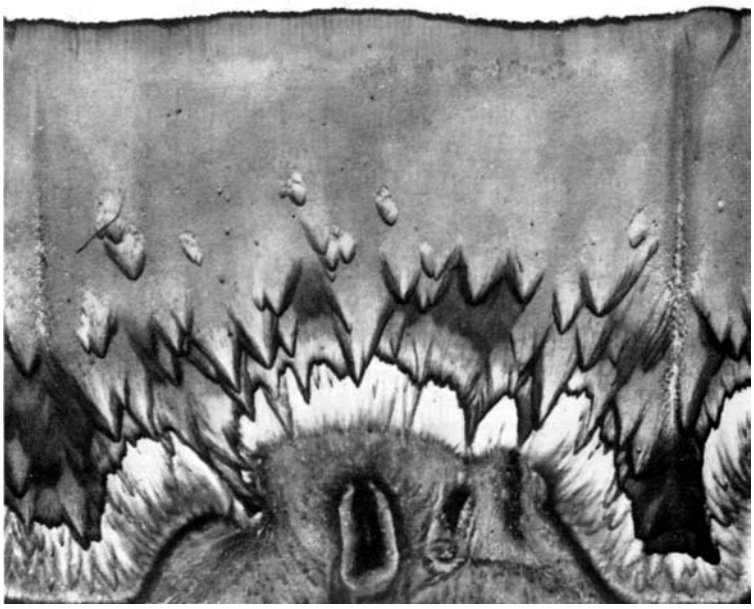


Fig. 129 1% silver nitrate and 1% iron sulphate plus natural formic acid extracted with alcohol

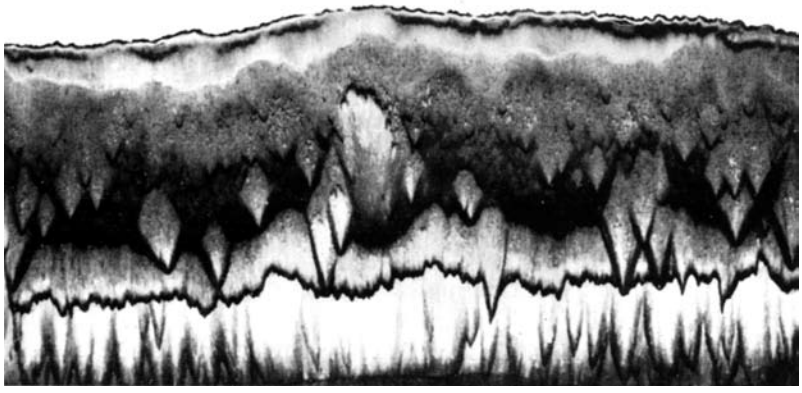


Fig. 130 1% silver nitrate and 1% iron sulphate -plus the extraction used in Fig. 129, after it had been kept for 8 years in an airtight bottle.

The powerful watery extract loses its effectiveness after some time. The alcoholic extract still produces the aforementioned changes, after having been kept in an airtight bottle for eight years. (Figs. 129, 130.)

We came to the following conclusion: The alcohol weakens the extract in comparison with the watery extract – but it preserves tins condition for a considerable time.

The best remedy will be made from fresh watery extract. The next best is a not too old alcoholic extract. Synthetic formic acid has not much value as a remedy.

Chapter XXI.
The Formative Forces in human excretions, studied with the help of Capillary Dynamolysis. The possibility of using this test for diagnosing diseases

The study of the formative forces in the Mineral Kingdom, and later on in the Plant Kingdom, quite naturally gave rise to questions about the formative forces in the Animal Kingdom; and so we started to study the excretions of various animals, and, at the same time, studied human excretions from various points of view. We will at first report about our studies concerning human excretions, and, in the next chapter proceed to animal excretions. Most of these experiments have been published in German "Mitteilungen des Biologischen Instituts am Goetheanum" Nr. 1 and Nr. 4 between 1934 and 1935. In the meantime our research work has been continued, and enormous material has been piled up, which we are doubtful if we shall ever have an opportunity of publishing. Since we are dealing with a completely new method of scientific research it is necessary to explain many details with photographs and the reproduction in print is very expensive, so that an exhaustive treatment of the subject is scarcely possible.

For our researches it is best to study urine excreted in the morning, because during day time the concentration of the excretions varies considerably, according to the amount of liquids consumed. The experiments are conducted in the usual way filter paper is dipped in freshly excreted urine. The liquid rises and reaches after some time the rising limit, which varies according to the concentration of the urine. For years we studied these variations of male and female excretions daily and got interesting graphs. But this part of our research work will be dealt with in another publication. After the filter paper has become dry again, we notice a slight yellow coloration and a more or less broad border zone (Fig. 131).

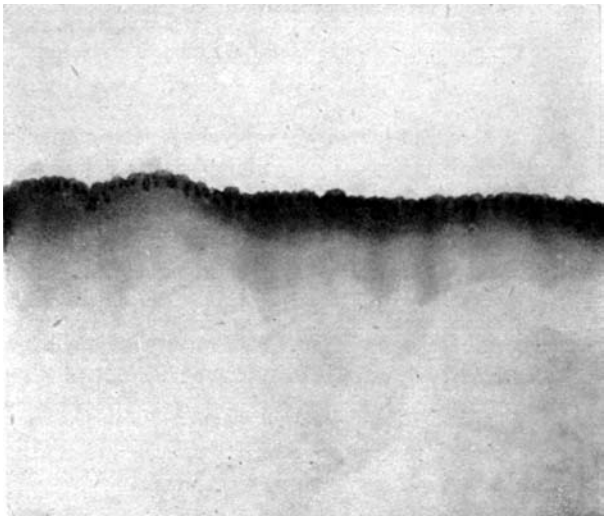


Fig. 131 Urine test of a healthy human being

These border lines vary considerably if the excretion comes from an unhealthy person, and there exists a detailed account of such variations in the book *Studien über die Anwendung der Capillaranalyse, I. bei Harnuntersuchungen, II bei vitalen Tinktionsversuchen,* by Friedrich Goppelsröder. Verhandlungen der naturforschenden Gesellschaft in Basel, Band XVII. We have mentioned already in our previous chapter, this well-known scientific method, and we appreciate fully its value; but the formative forces which are hidden in the various human and animal excretions cannot be found in this way.

Thus we use as a detector, as we have described for the study of the formative forces in the plant kingdom, metal salt solutions, for instance, nitrate of silver. Specific forms appear, which vary according to the individual from which the excretion is taken. Specially interesting forms are noticeable in excretions from unhealthy persons.

A much more interesting experiment, however, is if we **reverse the sequence of substances,** and let the metal salt – nitrate of silver, rise first into the filter paper. When this picture has become dry, we add the urine. The urine passes through the silver nitrate, and, during this process, engraves a beautiful structured picture. We add a coloured reproduction which can, at least to a certain extent show the original colours. The rising urine partly dissolves the silver nitrate deposited previously into the filter paper and carries this substance to the top, where we find it again as a brown border line, intersected with bluish-grey featherlike formations. Of course it would be necessary to reproduce many such pictures to give the reader a good basis for his own judgment. At present this cannot be done. Perhaps later on we can make a more detailed publication on this subject alone.

There is a great difference between the excretion of younger or older people. Younger persons, if they cue healthy, produce a more brownish colour and softer forms; older people, bluish-grey colours and stiffer formations. This phenomenon can be observed on Figs. 132 and 133.

A long and careful study is necessary to be able to judge with absolute certainty, whether the excretion comes from a perfectly healthy person, or whether pathological changes are present. Each individual has a characteristic formation. But it is possible to use our method of Capillary Dynamolysis to diagnose in the excretions various diseases. We carried out these observations for more than fifteen years, with a large number of healthy and sick people. Dr. Kolisko, as medical officer in the Waldorf School, Stuttgart, cared for about 1,200 children and made liberal use of this method for diagnosis; as he did also later on, in his clinic in Burghalde. From this experience we can state, that it is not only possible to give the correct diagnosis for various diseases, but we can also follow up the healing process. Capillary Dynamolysis is a very subtle method, which is able to show the beginning of a disturbance in the equilibrium of forces very early, much earlier than is possible with a chemical or microscopical test. The equilibrium of the forces is disturbed before we can see it in actual disease; that means it is possible to prevent the outbreak of a disease in time, and to continue the treatment long enough to ensure a real cure by watching the gradual recovery of the lost equilibrium. We report briefly a few cases:

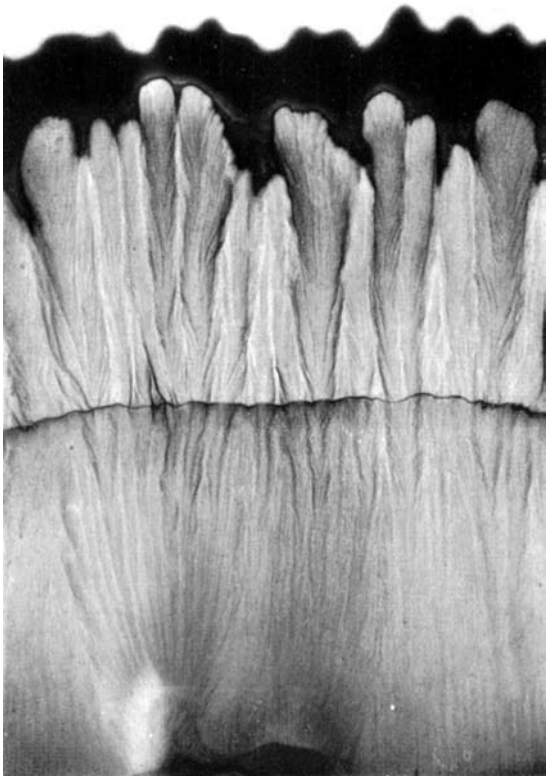


Fig. 132 Silver nitrate 1% followed by urine of a younger person

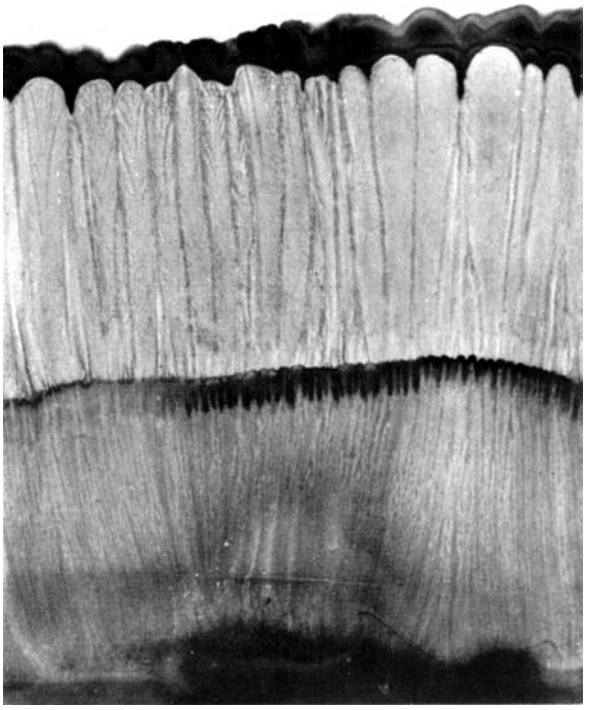
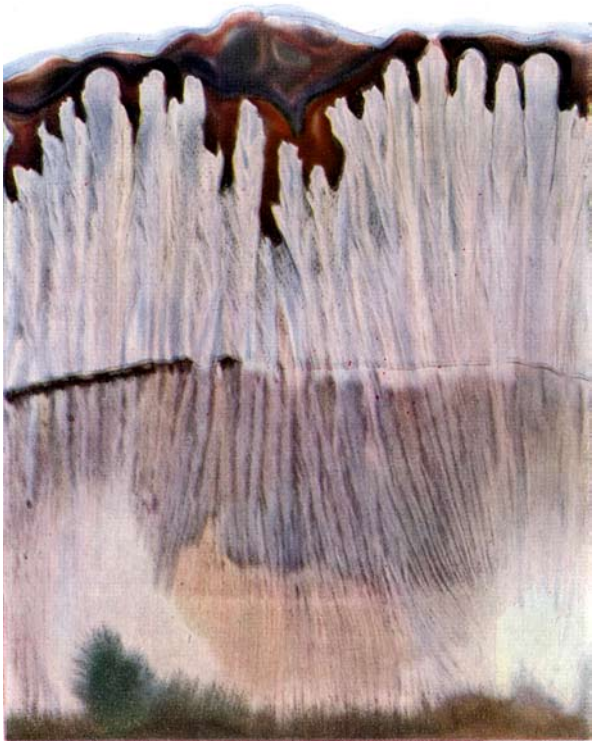


Fig. 133 Silver nitrate 1% followed by urine of a elderly person

Plate 1



1% nitrate of silver followed by human excretion

(1). Inflammation of the kidneys.

The urine of a young girl had to be tested, because the physician suspected nephritis. The chemical test (which we always carry out as a control measure) gave the following result colour of the urine – slightly yellow, spec weight – 1, 017; reaction – sour; albumen – positive. Microscopic test: a great number of leucocytes, some red blood corpuscles, crystals of calcium oxalate. The test with Capillary Dynamolysis produced the picture represented in Fig. 134.

It shows that the formative forces are disturbed. A young healthy girl never has in the excretion such veiled, greyish, dirty-looking forms. It is possible to diagnose with certainty the beginning of nephritis.

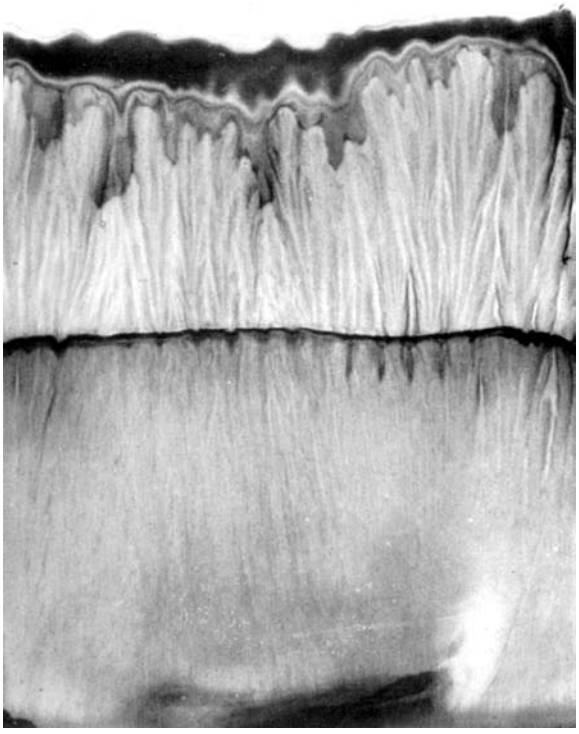


Fig. 134 Silver nitrate 1% followed by urine of young girl, with incipient nephritis

Two days later we had another specimen to test, and found that the albumen had increased, and the microscopical test showed that not only many leucocytes and some red blood corpuscles were being excreted, but that there were as well hyaline cylinders and other tube casts. It was quite definitely nephritis and the Capillary Dynamolysis (Fig. 135) showed clearly the further progress which the disease made, in reducing the normal formative forces to a great extent. The whole picture seems covered with a dirty greyish veil. After recovery, the capillary dynamolytical test revealed the restored, normal formative forces in Fig. 136.

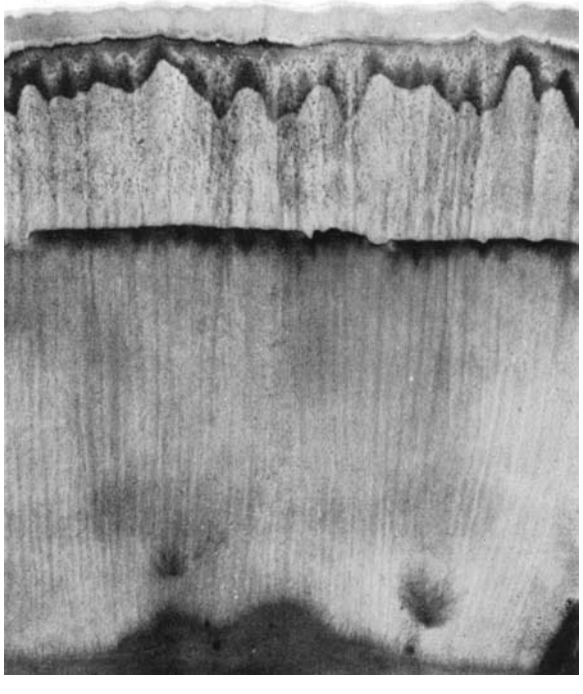


Fig. 135 1% Silver nitrate, urine excreted during nephritis

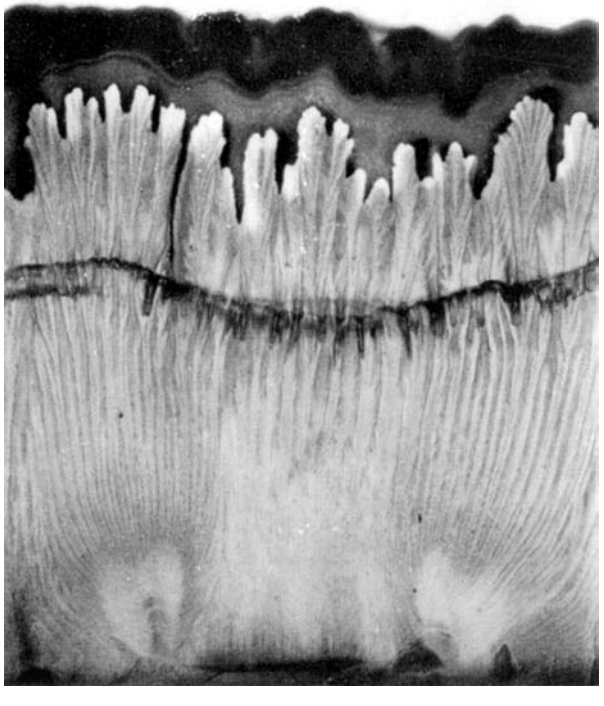


Fig. 136 1% Silver nitrate, urine excreted after recovery from nephritis

(2.) Example of a patient suffering from kidney stones.

This patient had been treated by his physician for a long time, and we were asked to test the progress of the treatment with our method. Persons suffering from kidney stones usually show very interesting phenomena in their excretions. The formative forces which are normally present, are to a certain extent intensified and deviate from their ordinary course. If we study, for instance. Fig. 137, we notice that the forms look twisted and the coloration is a more vivid brown. During the time of an acute nephritic colic, the excretion produced the picture represented in Fig. 138, where a strong radiating force penetrates the leaflike structures. The colour was between brown and orange. Such a test looks "beautiful" and inexperienced observers often come to wrong conclusions.

(3.) Example of a patient suffering from Diabetes.

A young girl of eighteen suffered for years from diabetes. The chemical test gave the following result: colour – light yellow, spec. weight – 1, 042; reaction – acid; albumen – 0; sugar content – between 6 and 8%.

The test with Capillary Dynamolysis tells us that the formative forces are practically effaced. If we study Fig. 139 we come to the conclusion that the excretion is devoid of all the forces which should radiate through it. A few days before the patient died, the test proved even more the complete lack of formative forces. (Fig. 140.) The colour of the picture had a warm brown tone.

We mention here only a few cases and give the proofs for one metal salt – nitrate of silver. We could as well make the Capillary Dynamolysis test with other metal salts. It is not difficult to make these tests as far as the technique is concerned. A child can dip filter paper in solutions and get "a picture", but to **read the result** needs a great experience, especially if the responsibility is undertaken to judge health or illness. Nobody should accept this responsibility before having acquired a thorough knowledge of the various substances used for the test. Mistakes may prove disastrous in this sphere.

For instance, we might test the various excretions with a copper salt. Again we find that each person reacts in a specific way. It is even possible to come to certain conclusions about the **temperament** of the person whose excretions we examine. We regret that we cannot go into details here.

If we use for the test sulphate of copper in a 2% solution, it is best to start the test with the urine and later on to follow with the metal salt. As an example we show in Fig. 141 such a test with the excretion of a healthy young man, in Fig. 142 the same test carried out with the excretion of the patient suffering; from nephritis and in Fig. 143 the test with the excretion of the patient suffering from kidney stones.

The test with silver nitrate used in the case of nephritis showed, that the formative forces were suppressed, the picture veiled. The same phenomenon we read from the test with copper sulphate.

The test with silver nitrate used in the case of kidney stones revealed exaggerated formative forces. The same phenomenon we find in the test with copper sulphate.

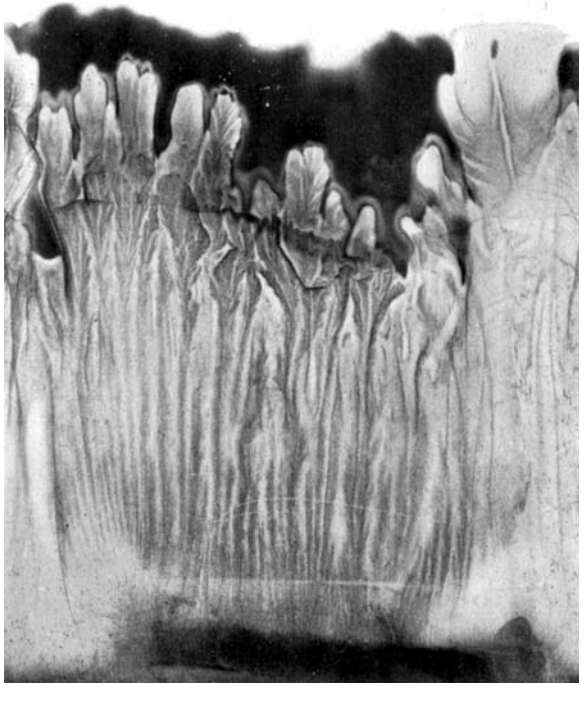


Fig. 137 1% Silver nitrate, urine of a person suffering from kidney stones

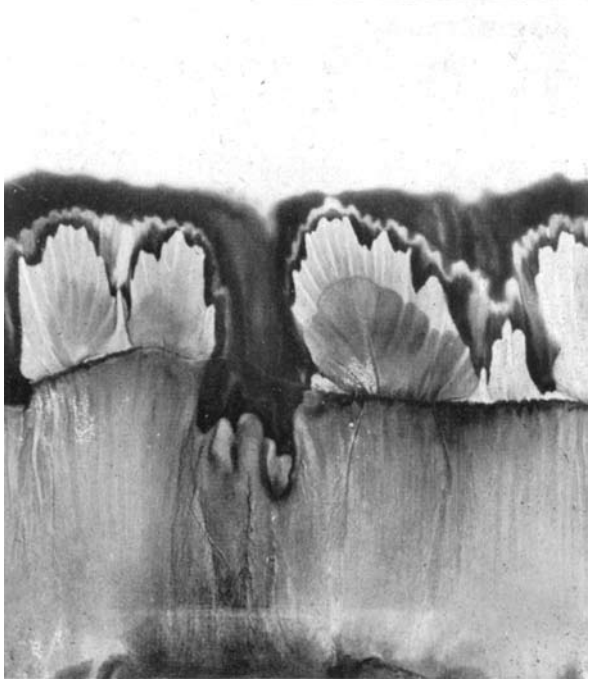


Fig. 138 1% Silver nitrate, urine excreted during an attack of nephritic colic

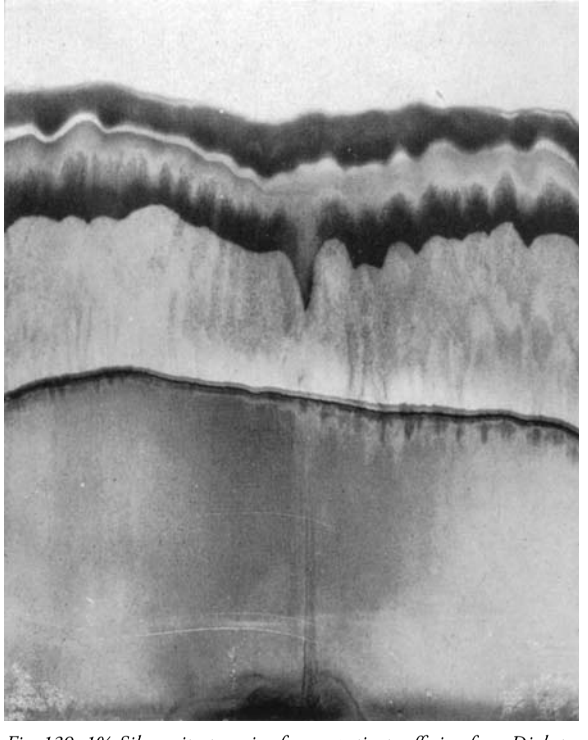


Fig. 139 1% Silver nitrate, urine from a patient suffering from Diabetes

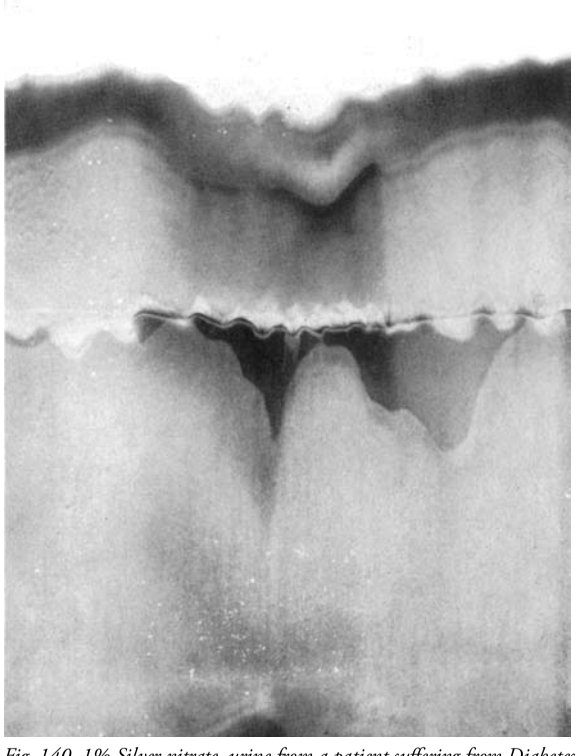


Fig. 140 1% Silver nitrate, urine from a patient suffering from Diabetes

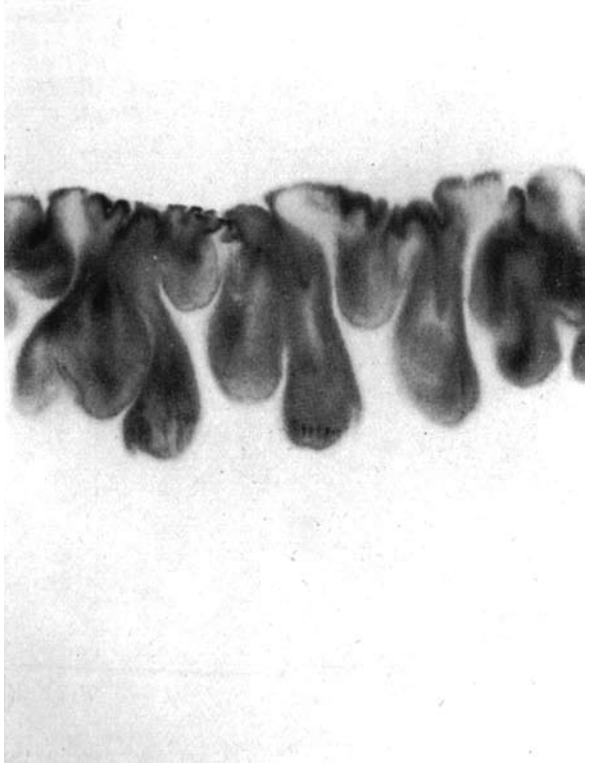


Fig. 141 Urine of a healthy young man followed by 2% copper sulphate

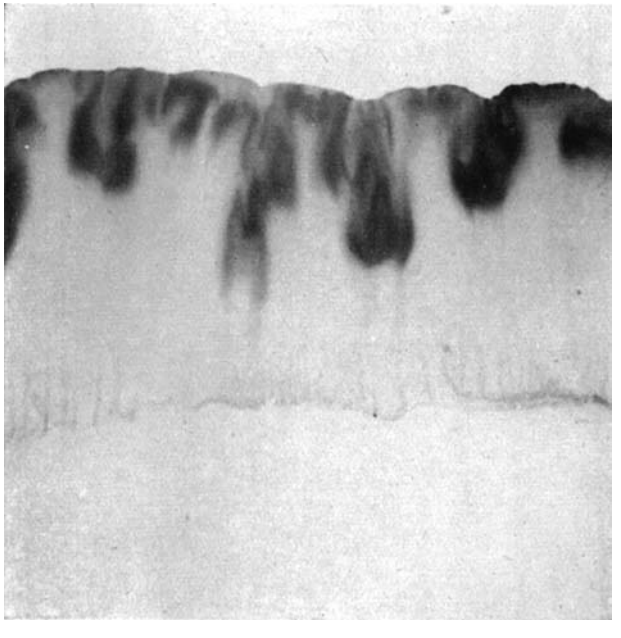


Fig. 142 Urine of a patient suffering from nephritis, followed by 2% copper sulphate

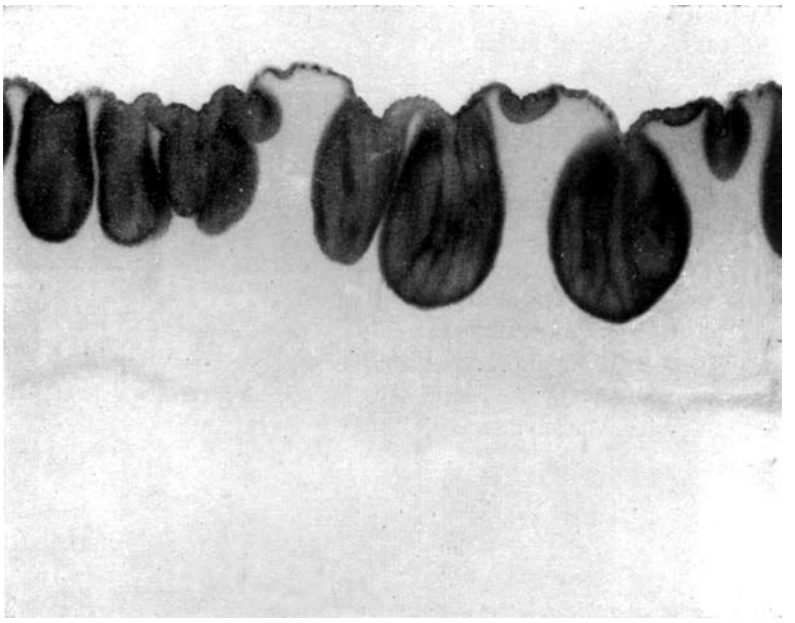


Fig. 143 Urine of the patient suffering from kidney stones, followed by 2% copper sulphate

We observe a too strong plastic force active. The single forms look like balloons fully blown up, ready to burst.

If we summarize briefly these few examples, we may say: In a healthy human organism we find a normal formative force acting within certain limits. These limits can be overstepped in the one or the other direction. Either the formative forces may be dimmed down (kidney inflammation) or even completely suppressed (diabetes) or they can be too strong, radiating through the kidney system in an exaggerated way, instead of being used in the organism; then kidney stones are deposited.

We want to point out, that these are only a few examples. We have collected an immense amount of material, which has convinced us that this method of Capillary Dynamolysis can be most helpful in medicine. The excretions do not only reveal diseases connected directly with the kidney system. An intimate study can penetrate also into the sphere of diseases belonging to the respiratory and circulatory system, as well as to the metabolic system. We regret that we cannot deal with all these problems in this chapter.

Another advantage of this method is, that we can diagnose the approaching illness much earlier, than with any chemical test. One example is, fur instance, if the chemical analysis is completely negative, although the physician suspects a certain defect. The Capillary Dynamolytical test reveals without fail, if the suspicion is justified or not. Fig. 144 represents such an instance, where the chemical analysis states: the excretion is perfectly normal; our test says, disorder in the respiratory system; there is possibility of asthmatic conditions.

Fig. 144 1% silver nitrate, Urine with negative chemical test but positive Capillary Dynamolytical test

A completely new and beautiful world opens for future research work. But we cannot emphasize enough: it demands a strict training and discipline. Since I have lectured for years about these subjects, I have watched how the public reacts when seeing such striking results It happens often that the eye gets caught by some unimportant detail which appeals to the aesthetic sense It has to be understood, that beauty **does not always mean health.** I sincerely hope that I can make it clear on these few pages which are at my disposal: For **the interpretation of these experiments we need sober judgment.**

In the case of kidney inflammation the picture is veiled by a dirty greyish appearance; in the kidney stones, it is veiled by a brownish-orange glow and radiating formations. We must understand that the truth is only to be found **behind both veils, the veil of greyish dirt, and the veil of glowing beauty**. Between both is the normal, healthy condition. The state of equilibrium can deviate to the one or to the other side; but each deviation means ill health.

Now we pass on to the next chapter dealing with animal excretions.

Chapter XXII.
Capillary Dynamolysis as a means of studying the qualities of animal excretions which thus enables us to judge their value as manure

We began these researches as early as 1925 and are indebted to the veterinary surgeon **Dr. C. Werr** for the general interest he took in the work, in sending us all the required samples of animal excretions. We were able to study hundreds of cows of various big cattle breeders in Germany and later on went through the livestock of many farmers. We started to lecture about this highly interesting and important subject in 1929, but we could publish only in an inadequate way, just touching the subject and printing one or another experiment – *(Mitteilungen des Biologischen Instituts am Goetheanum,* Nr. 1/1934, Nr. 2/1934, Nr. 3/1935). In our lectures and to visitors to our laboratory who wanted to see the originals of the experiments and hear how they were obtained, we gave many details which we have not published. Even in this book we are unable to do more than roughly outline our researches and give a glimpse into 18 years research work.

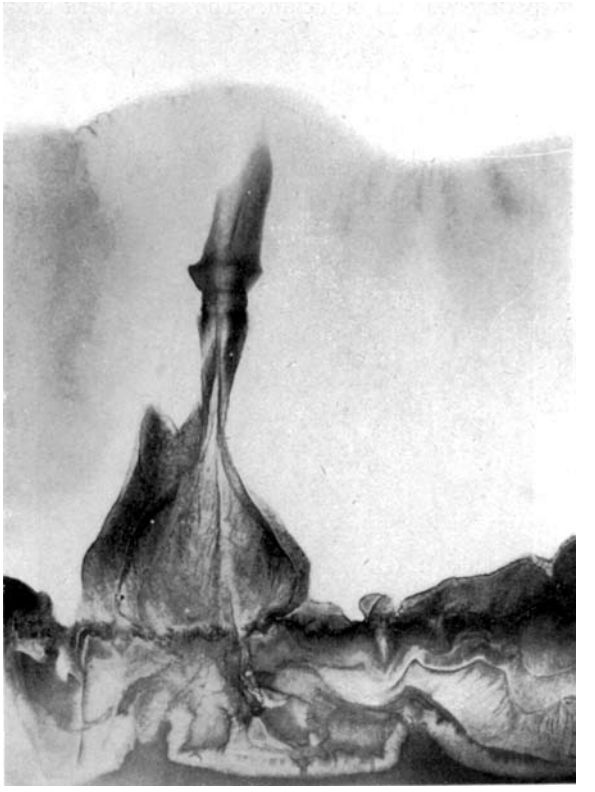


Fig. 145 Urine of a cow, followed by 1% silver nitrate

We start with cow's urine, making the same tests as described in the previous chapter with human excretions. According to the concentration of the excretion the rising limit varies, sometimes it is higher, sometimes not so high as water. When the cow is healthy, we get only a slightly yellowish coloured border line, more or less intersected with tiny waves. When we add nitrate of silver (Fig. 145) the specific formative force begins to work. The result is a rather coarse, simple, flame-like formation in the middle part.

If we compare this type of experiment with similar ones carried out with human excretions we come to the conclusion, that the formative forces acting in them are working in a much more subtle, we might even say, in a much more complicated way., The colours are also different. The animal excretion reduces the silver nitrate into a dark brown, sometimes reddish brown, whereas the human excretion changes it only to a light brown.

We reverse the sequence of the substances (see previous chapter) and find the same phenomenon; using as the first substance nitrate of silver, and afterwards the cow's urine, more characteristic results are obtained. The urine must rise into the preformed silver picture, and passes the border line formed by silver nitrate (coloured plate). Such an experiment looks beautiful. The top is dark brown, nearly black, with a metallic shine in it. This means that the silver nitrate has been reduced with a great strength. From the middle part flamelike forms rise. The inner part of these flames is clear yellow with orange shades. The border line which separates the flames from the dark silver nitrate surrounding, is of glowing orange The lower part of the picture, which is devoid of forms, is of a light orange-yellow. The immediate impression we get in looking on the original is: **how full of life the picture is.** Life forces stream through this picture. We turn back to the human excretion (coloured plate 1) and find it now in comparison with the cow's urine, **dead.** The blue-grey coloration, the carved in, sharp forms are in themselves beautiful, but mineralized and dead, if we compare them with the cow's urine. We add a few more examples of cow's urine, so that the reader may have a better possibility of judgment (Figs. 146 and 147).

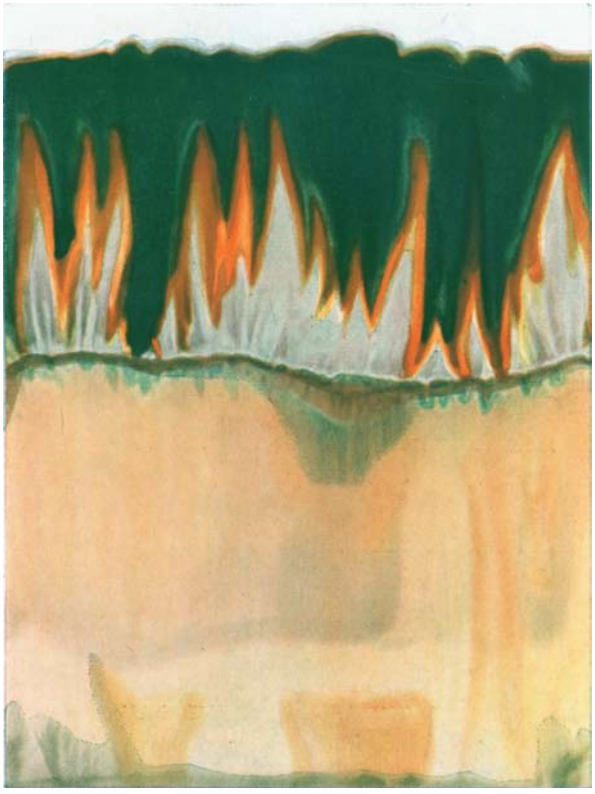
These experiments are of great importance for the farmer and gardener. They show plainly the difference between a living and a dead substance. We only look on these two types of pictures, then ask, **which substance is able to bring the forces into the soil?** There is not the slightest doubt that the cow's urine answers this purpose, but not the human excretion.

It is so simple to understand, too. The human being takes nearly everything out of the various foodstuffs that pass into his organism, and excretes the remainder – dead mineralized, lifeless substance. The cow needs an enormous amount of food and does not burn it completely in its digestive process It passes through the metabolic system of the cow, and, when excreted, still contains life forces which have undergone-a transformation through the cow's organism. If we bring this excretion back into the soil, we bring back life.

The liquid cow manure is a very valuable substance and it is a great pity to see how often it is wasted. How many farmers do not care for this liquid manure and just allow it to run away?

The life forces are wasted in our present agriculture, because we do not know where to look for them. Instead of life, which we throw away light-heartedly, we dig in the artificial, mineral fertilizers and kill the soil.

Plate II



1% of Silver Nitrate followed by cow's excretion

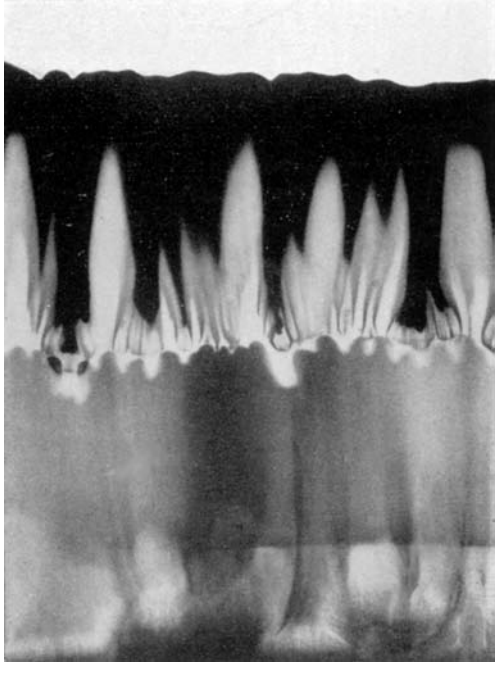


Fig. 146 1% silver nitrate followed by cow's urine

Fig. 147 1% silver nitrate followed by cow's urine

With Capillary Dynamolysis we may study the excretions of all our domestic animals and thus find out their respective value as manure. For instance, the horse urine is entirely different from the excretion of a cow in its life forces. Fig. 148 represents the experiment with nitrate of silver, followed by the excretion of a horse.

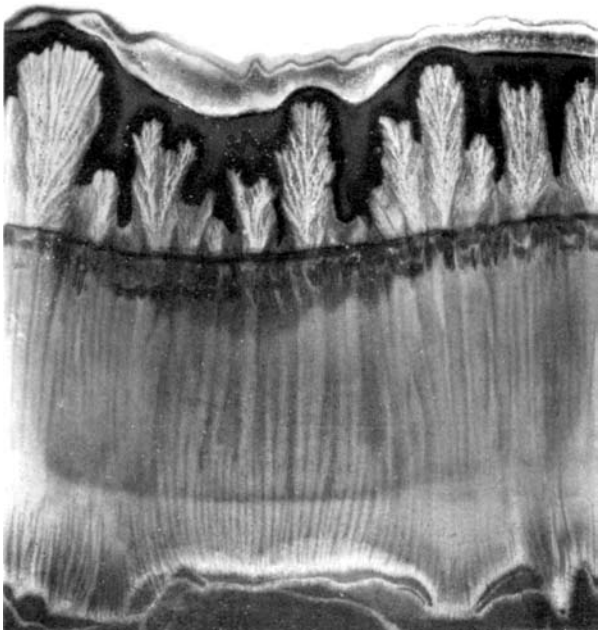


Fig. 148 1% silver nitrate followed by the urine of a horse

There is undoubtedly life force in the excretion, but considerably less than in that of the cow. The formations are more complicated but less vital. The colours lack the glowing orange shades, they are only vivid brown. Characteristic for horse urine are the tiny black spots which fill the single forms. We again regret that we cannot enter into details here.

The excretion of **pigs** is also extremely interesting. Usually we call the manure from pigs "cold" in comparison with the horse manure. The latter is a "hot" manure which we need in our warm beds or for mushroom culture. Of course the horse manure produces not only heat, but we appreciate this quality especially. The pig manure has very little life If we study the pigs, we know that they again use thoroughly the food they get; they transform it into fat, put on weight and therefore their excretions cannot retain many valuable substances. Pigs are greedy, and make the best possible use of their food. Pig manure alone could not help the soil very much. The Capillary Dynamolysis test gives a good illustration of the qualities hidden in pig's urine (Fig. 149).

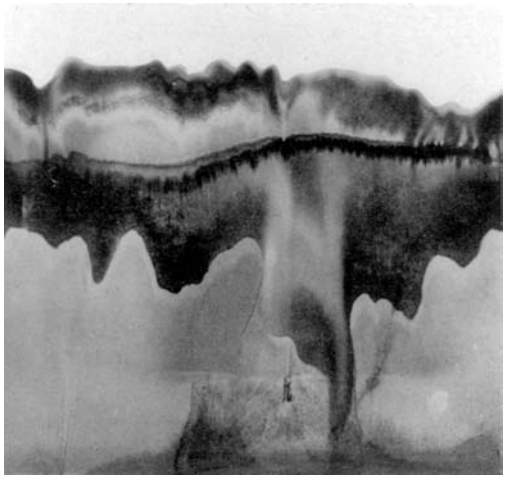


Fig. 149 1% silver nitrate followed by the urine of a pig

We studied the excretion of pigs with great care for a long time, to see if perhaps another combination of metal salts would show better results, and reveal stronger life forces. Whatever we chose, we got the same negative effect. For instance, we may compare the result obtained with gold chloride and the excretions of a pig, a horse, or a cow (Figs. 150, 151 and 152).

Judging the results from the point of view of value as manuring substance, we must state, that the pig's excretion has the lowest value, the second best (in this series) is the horse, and undoubtedly the best, is the cow's excretion. The pig's excretion completely destroys the inherent beauty of gold chloride; the pure colours of yellow and mauve give way to a dirty greyish-mauve which spreads over the whole picture and no form whatsoever appears. The horse urine also makes the pure colours of gold chloride look less pure, greyish-mauve, but characteristic forms are engraved. The cow's urine is chaotic in its formation, but brings out a great beauty as far as colour is concerned. The original impresses us again with the quality of **life**; it is a chaotic, but very active life force visible. The horse urine is less permeated with life, but contains more formative strength. Thus we might grade the various excretions according to their content of life.

Fig. 150 *Urine of a pig followed by 1% gold chloride*

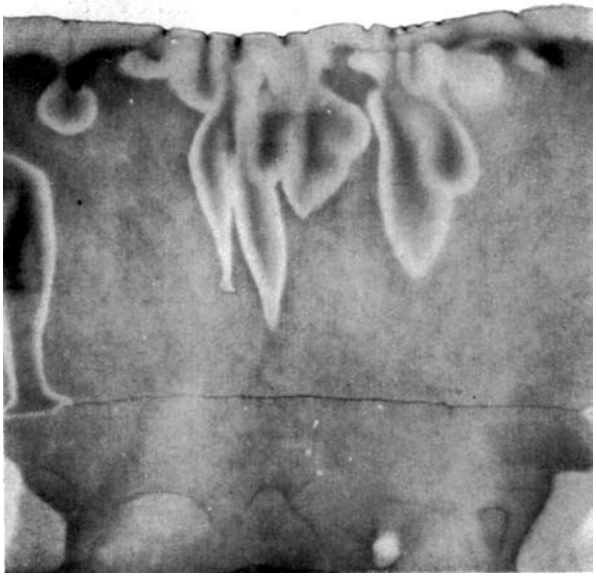


Fig. 151 Urine of a horse followed by 1% gold chloride

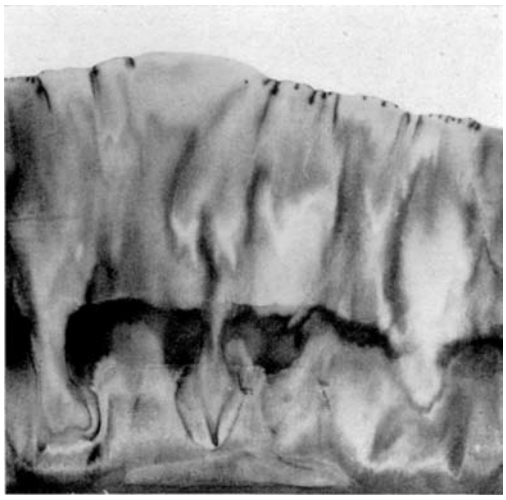


Fig. 152 Urine of cow followed by 1% gold, chloride

A wild **boar** differs from an ordinary domestic pig. (Compare Fig. 153 with Fig. 150).

The test with silver nitrate shows a very clear picture, quite unlike the result obtained in Fig. 149. We must say the photograph looks much too beautiful; the original simply conveys the impression of dirtiness and dullness, whenever we use pig's urine. The wild boar's urine always reacts with silver nitrate in a peculiar way. We ask the reader to pay attention to those strange lines engraved in Fig. 154. They look exactly like cracks in a wall. Their colour is dark brown with a slight red shade on a light-brown background. The test represented in Fig. 153 with gold chloride looks quite lively and does not disturb the display of beautiful colours, belonging naturally to tests with gold chloride.

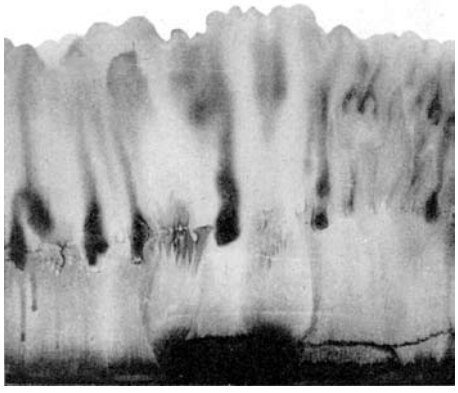


Fig. 153 Urine of a wild boar followed by 1% gold, chloride

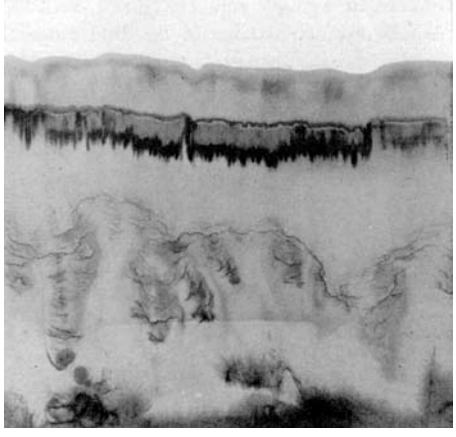


Fig. 154 1% silver nitrate followed by urine of a wild boar

In the same manner we can study (and have actually done so) the excretion of all domestic animals, sheep and goats, cats and dogs, etc., and can, after some time, discriminate quite objectively between their value as a manure. We can state if they have retained more or less life forces.

We would like to give one more example for the purpose of demonstrating the manifold possibilities given in our method of capillary dynamolysis. For instance we study the excretion of a sheep. Its urine has a specific gravity of about 1.030 compared with 1.032 of a cow, 1.040 of a horse, 1.012 of a pig. A sheep discharges about 1 to 5 litres urine daily (a cow between 10 to 25 litres). Hippuric acid is abundant, especially by a diet of new meadow hay. Also the urine of cows is rich in hippuric acid although less than the urine of horses. The capillary dynamolytical test with silver nitrate gives a vividly coloured and richly formed picture.

Fig. 155 1% silver nitrate followed by sheep's excretion

The original colours are dark brown and yellow, but do not produce the warm glow usually present in a test of cow's urine. Characteristic tests for sheep excretions can be obtained with

another modification of our research method. Until now we have only published experiments, where the liquids were **rising** into the filter-paper vertically. There is also the possibility to let the substances spread out horizontally. The filter-paper is fixed on a large wooden frame and from the centre the liquid is allowed to contact the paper. At first a circle is formed by the sheep urine and then silver nitrate is added and passes through, colouring and forming together with the excretion.

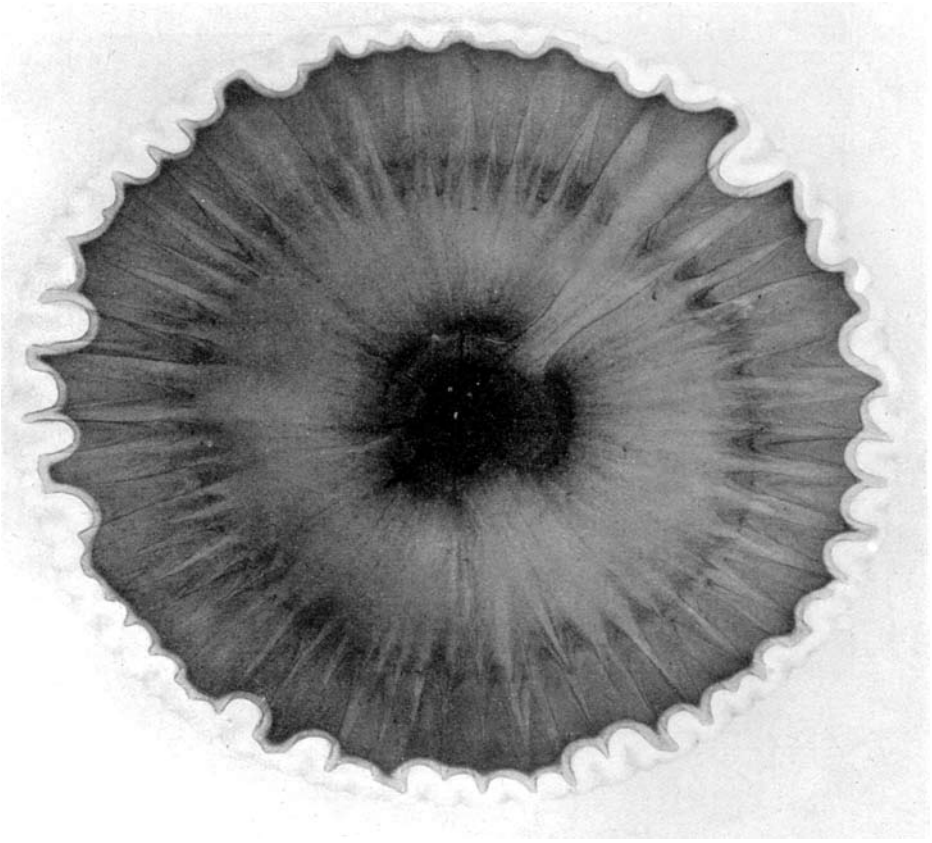


Fig. 156 Sheep's excretion, followed by 1% silver nitrate

The main characteristic is given by the strong radiation permeating the whole picture. Every healthy sheep will show the same phenomenon. We add one more example of this type of experiment in fig. 157.

This method can of course be applied as well to experiments with plant juices, or metal salts alone for special purposes We cannot enlarge here on this particular branch of capillary dynamolysis There are many advantages in it but also some disadvantages. We add two examples with plant juices.

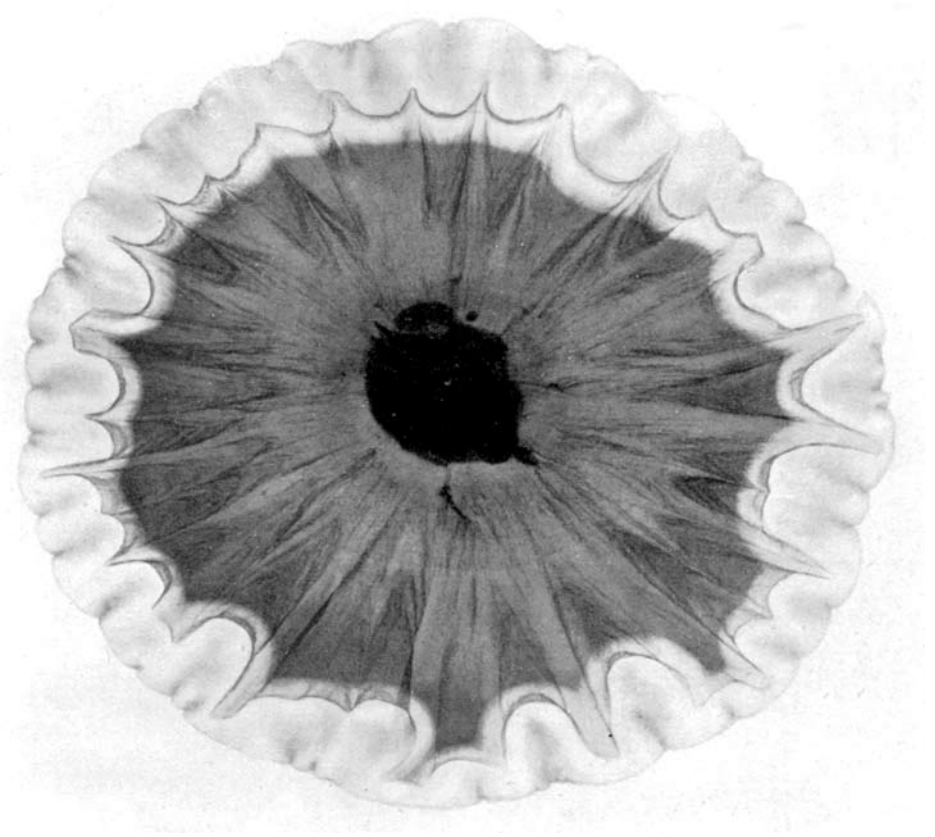


Fig. 157 Sheep's urine, followed by 1% of silver nitrate

Apart from these researches which we carried out, having in mind a purely agricultural viewpoint, we also studied the excretions of other species in the animal kingdom: camels, bears, elephants, lions. For this purpose we had to make friends with the personnel of zoological gardens, or sometimes we asked permission to collect the excretion of wild beasts in circuses.

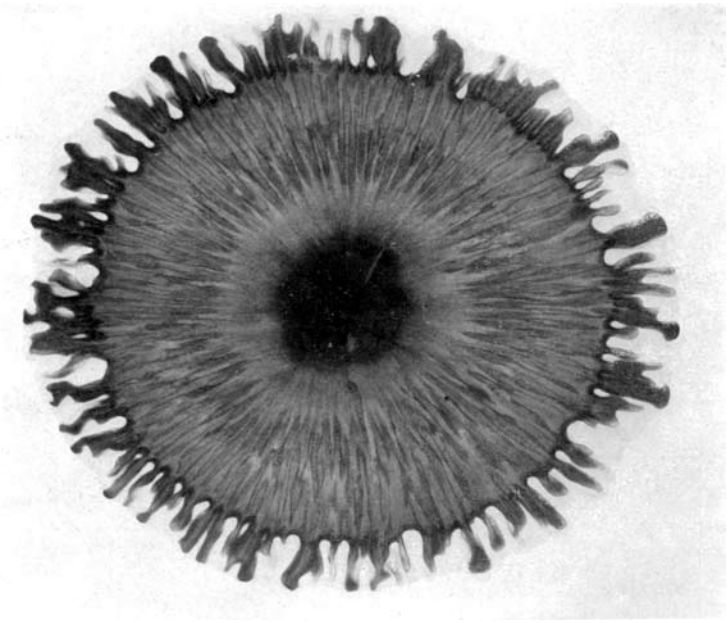


Fig. 158 Extract of Dandelion (flower) followed by 1% silver nitrate

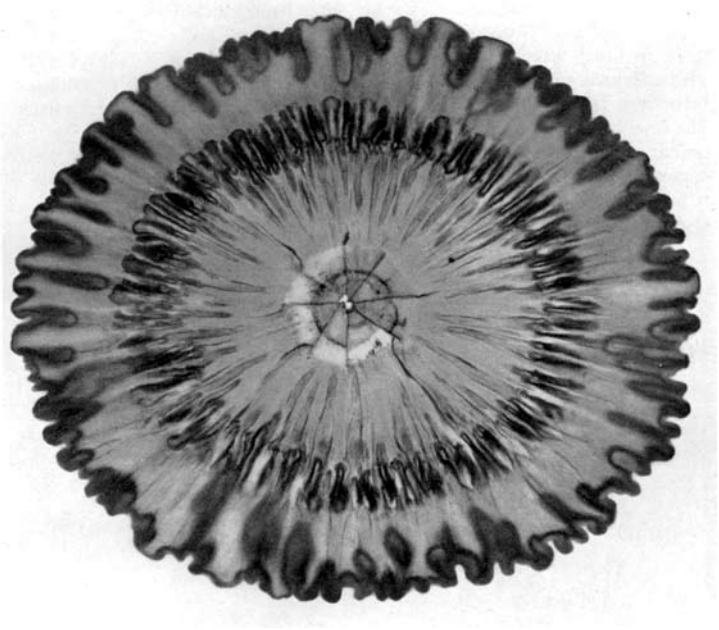


Fig. 159 Extract of a carrot, followed by 1% silver nitrate

Chapter XXIII.
Capillary Dynamolysis used for Diagnosing Animal Diseases

In Chapter X we explained the possibility of using our method for diagnosing diseases in human excretions, and the same method can be used for animal diseases. But again we have to point out, that first it is necessary to have a thorough knowledge of animal excretions gained through intensive research work carried out with healthy livestock. The various breeds have characteristically different formative forces in their excretions. Just as we have various qualities of milk yielded by various breeds, we have also various qualities of excretions. There is a difference between young or old animals. The excretion responds to each change of food. The cows have an enormously developed metabolic system (we refer to our chapter dealing with Foot and Mouth Disease) and every change in their metabolism is expressed in the excretions. Thus a real, intimate knowledge of all those details is required here. Even the cows vary in their temperaments, and we find typical changes due to this fact.

We are again faced with an absolutely hopeless task: to demonstrate a vast sphere of scientific research work with a few examples and a few sentences owing to paper restrictions and the great cost of a publication containing many illustrations.

Fig. 147 represents the result obtained with a certain breed. The variations in the same **breed** are not so enormous, as those we find studying quite a different breed of cows We hope to give a slight idea of those differences in reproducing the Capillary Dynamolytic test of a perfectly healthy cow belonging to another breed in Fig 160.

Fig. 160 1% silver nitrate followed by cow's urine

Again another type, but more similar to the one described in the previous chapter, is represented in Fig 161 the cow and Fig 162 the calf belonging to this cow.

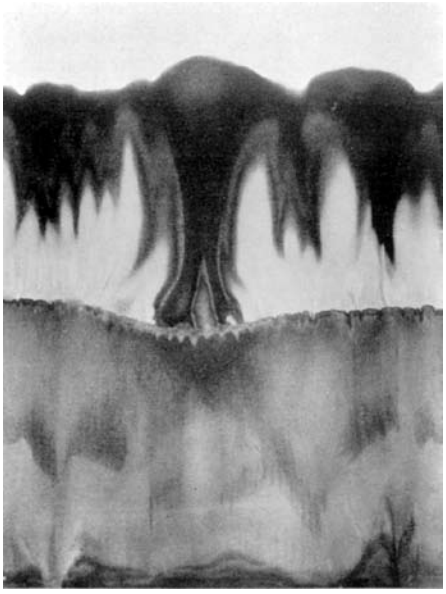


Fig. 161 1% silver nitrate followed by cow's urine.

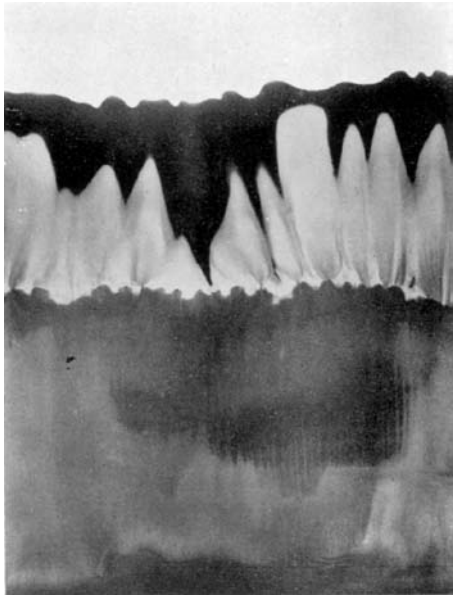


Fig. 162 1% silver nitrate followed by the calf's urine

Both tests are beautifully formed and coloured; both are permeated with a strong life force. The trained eye can easily find that they "belong" to the same breed, only the one test shows a less developed formative force. The calf has not yet the burning torches of the fully developed animal. The structure is softer, wavering between round and pointed forms, the coloration is also softer in its tone.

Again we ask an interesting question: how long may we keep such an excretion, so that it still retains life forces, valuable as manuring qualities? For this purpose we kept about eighty specimens of various breeds in airtight bottles for ten years and then repeated the experiment. The result was extremely interesting. As far as the colour of the tests was concerned, the quality of the various excretions remained constant for ten years; as far as the formative forces were concerned, they were less impressive, but still much could be seen. We give one example for this astonishing phenomenon in Fig. 163 the same urine as used in Fig. 162 from the calf – but ten years later. The experiment represented in Fig. 162 has been carried out in 1926 and the corresponding test with the same excretion kept in an airtight bottle has been carried out in 1936.

Since all the examples of cow's urine given until now, represent German breeds, we find it necessary to add a few English varieties.

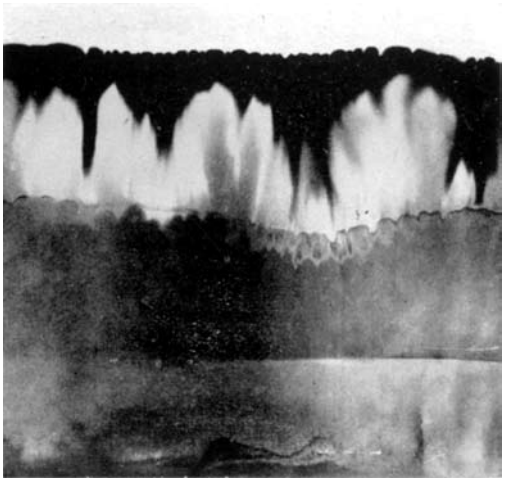


Fig. 163 1% silver nitrate are followed by calf's urine (kept ten years)

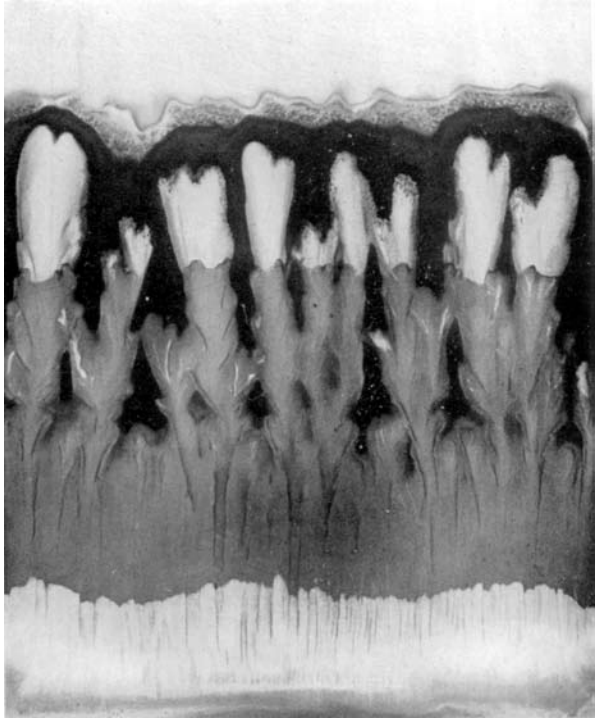


Fig. 164 1% silver nitrate followed by urine of shorthorn cow.

Fig. 165 1% silver nitrate followed by urine of shorthorn calf

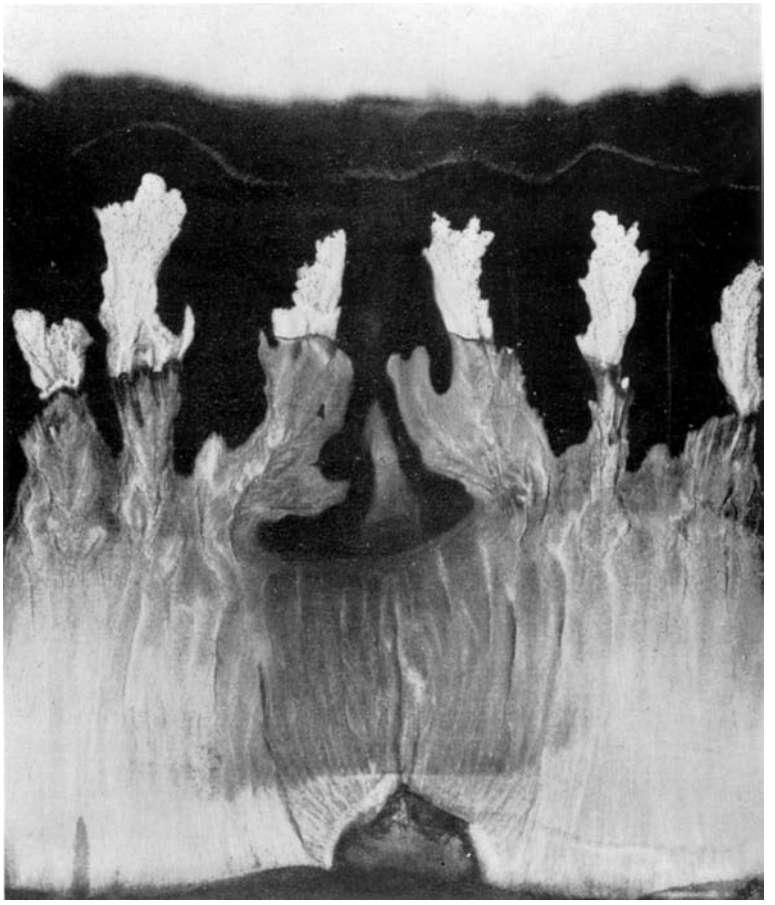


Fig. 166 1% silver nitrate followed by urine of Jersey cow

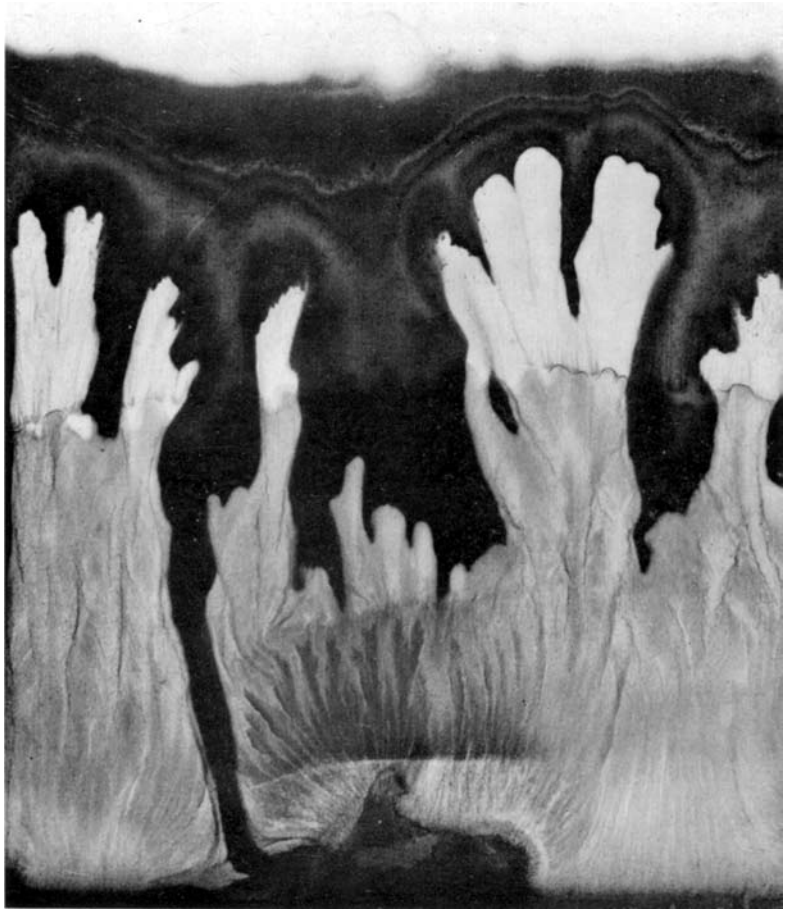


Fig. 167 1% silver nitrate followed by urine of black Welsh cow.

Tuberculosis in Cows:

We take one example from the chapter on disease. Everybody knows how widespread tuberculosis is in cattle. We need not go into details about this. It suffices to state: it is a fact that the percentage of tuberculosis in cows is increasing and that means a great danger to public health. Of course the milk is sterilized – but what does it mean, to sterilize milk? We take away life forces contained in the milk. More will be said about this in the other chapters of this book. Here we only state the plain facts.

The excretion of cows diseased with tuberculosis produces characteristic changes in our Capillary Dynamolytical test. For instance, we examine all the cows of a certain breed belonging to one farmer. They produce, if healthy, pictures of the type shown in Fig. 147 and if we get a test similar to Fig. 168 we can be certain that this cow has tuberculosis in a "slight degree" – still it is sufficient to make the excretion less valuable for manuring purposes. The original lacks the glowing colours, it is dirty brown, the characteristic flaming torches are extinguished, streaky lines run from top to bottom.

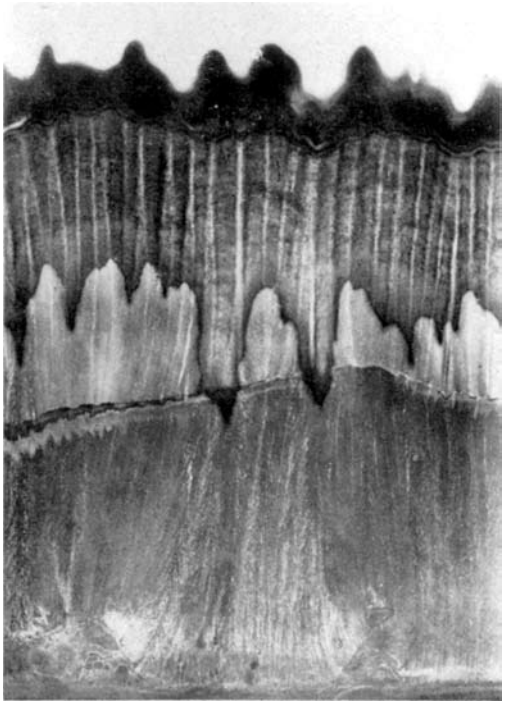


Fig. 168 1% silver nitrate followed by excretion of tuberculous cow

Fig 169 is another example of an excretion from a cow suffering from tuberculosis It shows the same lack in vivid colours, it is less veiled and dirty than the test Fig. 168, but shows the same characteristic streaks running from top to bottom. Still we consider this a more advanced case – the formative force has been more suppressed compared with test 168.

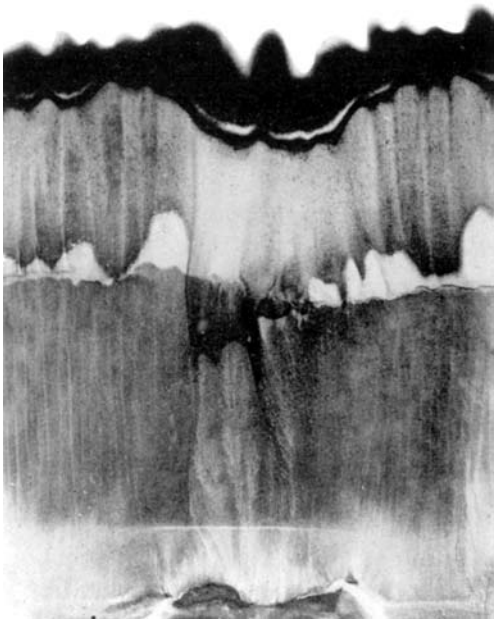


Fig. 169 1% silver nitrate excretion of tuberculous cow

In Fig. 170 we demonstrate a very advanced case of Tuberculosis having lost all the brightness of colours and all specific formation belonging to a healthy cow's excretion.
There are quite definite changes in the excretions which point to various diseases. We cannot go further into detail here, and must leave this to special publications later on. The great advantage of our method lies in the fact that we can diagnose tuberculosis in a very early stage, earlier than the veterinary surgeon can find it, earlier than the usual scientific tests can trace it, because the changes are earlier visible in the **life forces** of the animal, and later penetrate the various organs. Thus our method would enable treatment to be started at a very early stage, with a greater hope of curing the diseased animal. But certainly it is much better to raise our whole agricultural life to such a standard, that we avoid diseases. To achieve such a renewal in agriculture, or perhaps, more accurately: to show how such a renewal may come about, we have written this book, Agriculture of To-morrow.

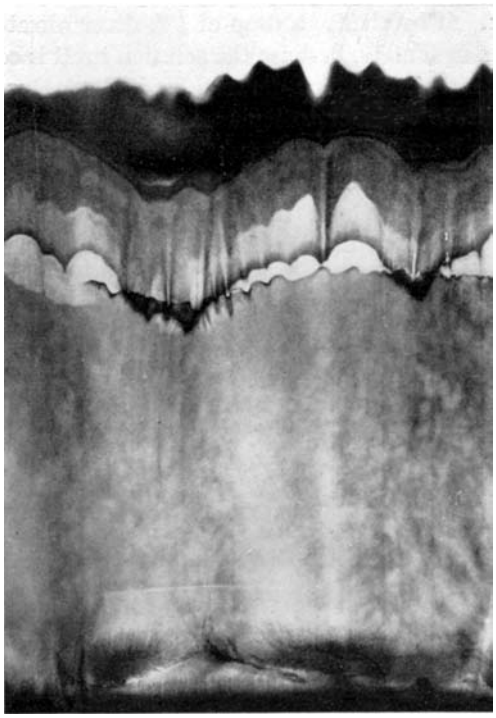


Fig. 170 1% silver nitrate followed by urine of a cow in an advanced state of tuberculosis

What does it mean, that the excretion of a human being reduces the silver nitrate so that a greyish-blue or a light-brown colour prevails in the filter paper test, and that on the other hand, the excretion of animals, especially of cows, reduces the silver salt to such a degree, that glowing orange shades arise, and brown, darkening nearly to black, with metallic shine? We have given much consideration to this fact, and want to explain it quite simply. Whenever we expose a silver salt to light, it reacts to the light. If by chance a drop of 1% silver nitrate falls on our clothes, we do not notice it immediately, because the solution itself is colourless; but after a while, a yellow spot is visible, which darkens gradually. Our experiments use this capacity of silver nitrate to react to light and thus make visible what else would remain invisible. We have studied this substance ceaselessly for more than twenty years now and published a book about the connection between Silver and the Moon in 1929. We studied silver and its effect on Gold, Iron and Copper salts, etc., and have also, in this connection made various publications. This means an extensive study of **inorganic** matter is in the background of our study dealing with **organic** matter. We observe that, when we combine inorganic substance with an organic substance – plant juices or animal excretions – the strength with which the silver salt is reduced, varies considerably. Again, as a certainty, we may say: the stronger the influence of light which acts on a silver salt, the stronger is the reaction. If we expose nitrate of silver experiments to bright sunlight in summer, the picture is certainly darker brown, than if we expose it to the less bright sunlight in spring. Increasing light means increasing darkening of the silver solution on filter paper or any other material. The dif-

ference between an experiment with silver nitrate and organic substances is clearly demonstrated by a more vivid coloration and this phenomenon can be watched still more in using animal excretions. It is an **effect of light.** But where does the light come from? We make various tests at the same time: silver nitrate alone, silver nitrate followed by human excretion, silver nitrate followed by animal excretions. They definitely show that the silver nitrate has been reduced in various degrees. The light which comes from outside is the same for all the experiments, still we observe a greater or less great effect of light. Since it cannot come from without it must come from within. The **organic substances contain various degrees of light activity in themselves and display this phenomenon in the Capillary Dynamolytical test.** Inner light and outer light meet.

This very simple test is nothing else but an interplay of the forces of light and substance.

Studying the various diseases we study the changes taking place in the light-metabolism. We have not only the crude metabolism of food, we have also the much finer metabolism of light. If we look at these tests from such a viewpoint, much light is thrown on certain diseases. If we have to deal with tuberculosis, the silver cannot be reduced in the ordinary way. There is not enough light activity in the diseased cow. (We find similar phenomena in cases of human tuberculosis.) There are diseases, where we must say, the light-metabolism is disturbed the other way round. Too much light is given off into the kidney system, is excreted, instead of being used inside the organism (e.g. kidney stones). If we understand in such a way the various entities in nature, we shall also find the right remedies to bring back the disturbed equilibrium.