

V The Sal - Sulfur polarity in the blood

So far, we have considered many details concerning the blood and suggested an ordering system. Now, an attempt can be made to make the whole come alive from different points of view. Division of the whole into a cellular and a plasmatic aspect had emerged right at the beginning. With the cellular elements reference was made to progressive devitalization - from the lymphocytes, which are capable of division, highly reactive and always able to migrate, to the old granulocytes, the thrombocytes that develop when the nucleus is lost, and the erythrocytes with their low water concentration and maximum devitalization. Loss of the nucleus and 95% of cell plasma was mentioned. Essentially, form is retained by all cell elements in the process of devitalization. The vital (small) lymphocytes are still quite spherical, the granulocytes oval to round, the thrombocytes and erythrocytes round and flat. Hemoglobin is deposited in this form, which has changed so little from the original, and the cell then persists in this substantially fixed state for about 120 days. This process of a living, evolving entity becoming frozen in a persistent form gives rise to an organ that is able to expose itself, to the greatest possible extent, to the outside air and take it into itself. We may call this "giving oneself up to the outside world." Such openness to the outside world, on one hand, and the process of development, on the other, have been known as the Sal process from antiquity (Steiner, 23 March 1920). No other organ, no other function in the human organ has this dual aspect of "dying into form" and "being open to the world" to such an extreme degree as the red blood cell. In the lung, the blood - here above all the red cell - is exposed to the greatest possible degree to the outside world; the process of oxygen coming into the blood from the air we breathe is referred to as passive diffusion and proceeds at high speed. Active life processes designed to overcome anything foreign hardly intervene at all. In its genesis and function, the red blood cell is the Sal pole among blood constituents. At the other extreme, it has not so far been possible to create an ordered system for the blood proteins. We have to use the classification into immunoglobulins, inflammation proteins, coagulation factors and inhibitory/transport proteins, a classification based on cell characteristics. Metallo-

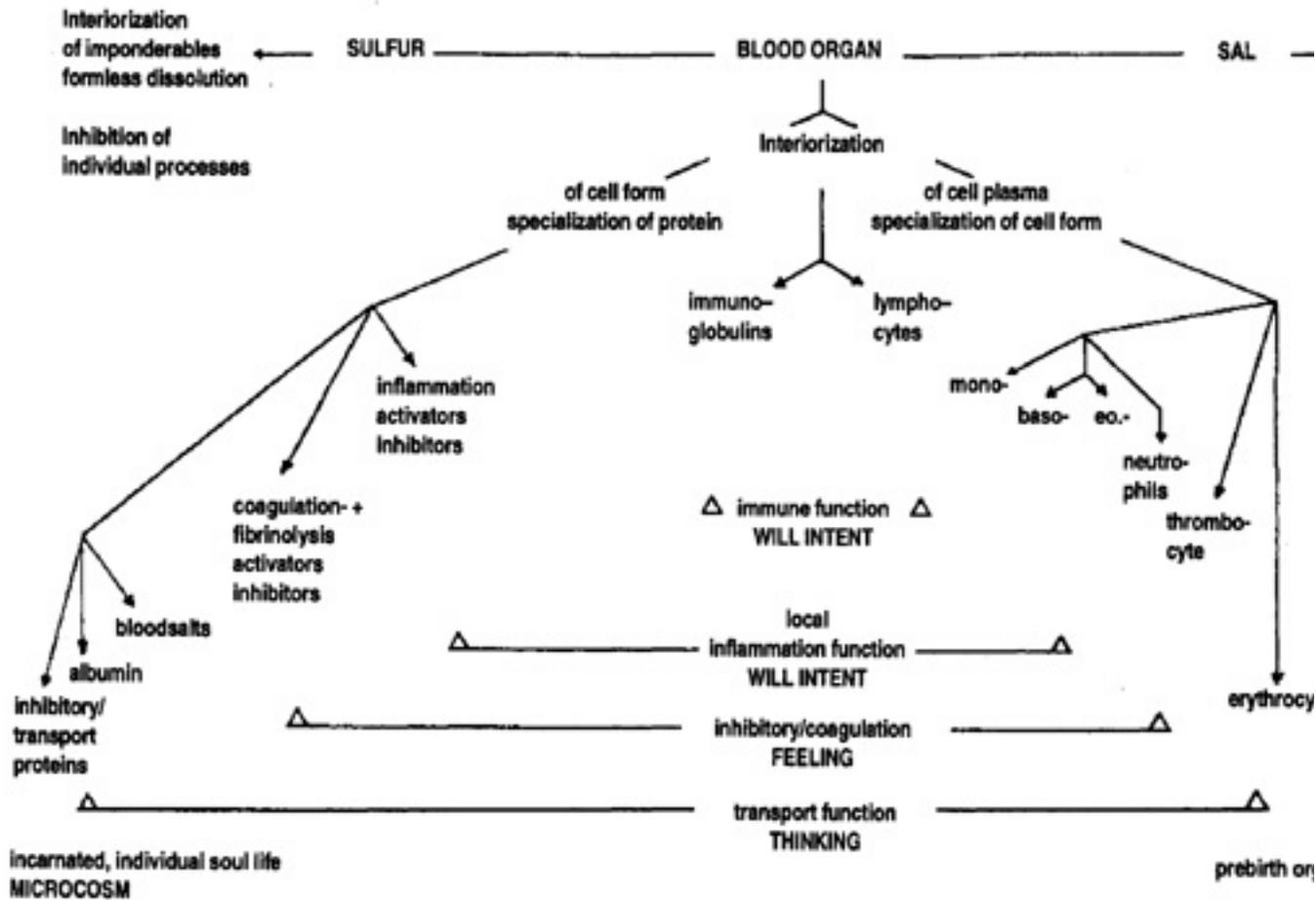


Fig. 16. Ordering system for human blood

proteins were seen to represent one extreme in the series. In the same lecture, Steiner characterized the Sulfur tendency - again speaking of both form and functional quality - form being shown as "formlessness in a state of flux" and functional capacity as "interiorizing imponderables." In the classification used for the blood these two characteristics apply to inhibitory/transport proteins, above all metalloproteins. Imponderable trace elements are interiorized in formless proteins and prevented from developing their own processual activity in the blood. The highly specialized metalloproteins are thus on the Sulfur side of the blood. Among transport proteins we have a sub-classification, with blood salts representing the Sal pole. Salts tend to be open to the outside world in osmosis, but they do not assume rigid form. Albumin is the mediator in this sub-classification. In the whole system, the immune system with its cellular and humoral

components is the mediator between rigid Sal conformation and the dissolution characteristic of flowing protein, functional openness to the outside world and the way this lies hidden at the Sulfur pole. If there is infection, the immune system is open to live influences from the outside world. Immunity develops as the organism's active response. The ability to learn something new, which exists at the level of unconscious life processes, correlates with the embryonic gesture of development. Lymphocytes act as though they still were early embryonic blood cells. Functional maturity is gained with practically no aging; serum is actively secreted, powers of centrifugal and centripetal migration are retained, as is the ability to divide in the periphery. Retention of such embryonic qualities makes the specific immune system highly functional. It is the last to mature, both ontogenetically and phylo-genetically, preserving its wide variety of and capacity for development, mobility and vitality. This middle system in the blood holds the balance between blood cells that tend to die off and the specialized blood proteins. It is the Mercury quality of a living whole. *Here, you have two opposite states in the outer world of nature, the Sal principle of action and the phosphoric principle of action (Sulfur). Between them is the Mercurial principle of action... The mediating principle in the outer world of nature includes everything that neither gives itself up strongly the way the Sal principle does, nor powerfully interiorizes imponderables, but... holds the balance between these two activities by seeking to achieve the droplet form* (Steiner 25 March 1920). The form quality of the mercurial middle presents in the blood in the "droplet form;" the functional middle between "giving itself up to the outside world" and the hiding, interiorizing of imponderables reveals itself in new immune responses and learning after every infection. In another lecture, Steiner characterized the protein aspect of the middle: *The principle referred to as "the Mercurial" that seeks to achieve the droplet form-you always have it in you in your protein constituents* (Steiner 1923). In a lecture given to workmen, he emphasized the vitality of this middle principle: *The white blood corpuscles are full of life. They keep milling around in the human blood... They surge through the blood vessels like the blood.... There they become... gourmets and go as far as the surface of the body. They crawl around everywhere in the body which has cells full of life in its blood, the white corpuscles, which want to live*

and live and live (Steiner 1922). This characterization does not relate to all white blood cells, since granu-locytes no longer have that vitality. He was speaking of the lymphocytes. The blood as a whole shows inner polarization into a Sal and a Sulfur side, both highly specialized. This specialization evolved in 3 (2) stages during embryonic development, with no further change possible after this. Both Sal and Sulfur side are old, specialized and (ontogenetically) not capable of further development. The young mercurial process is apparent in the reactive immune system which is capable of change. The nonspecific inflammatory response system and the coagulation system are metamorphic stages between the two extremes on one hand and the mercurial middle principle on the other. **VI Life processes in the blood organ**

The seven life processes as functional organs of the living organism were described by Steiner in 1911 and 1916. Little work has so far been done in the medical movement to develop this aspect, presented out of the science of the spirit, so that it may help us understand and treat diseases. As "process organs" the seven processes enable the human being to relate to the outside world. Steiner referred to them as *breathing, warming, nutrition, separation, maintenance, growth, reproduction*, saying that the choice of terminology was not final. Lindenau and Goebel have used different terms for some processes in their work, choosing terms more related to the phenomenology. The activities of the seven processes are briefly characterized below, to provide a background against which we may consider the blood organ. The first three processes refer to the activity the organism develops in dealing with foreign influences from the environment. A common factor is that the organism has to evolve energies that enable it to overcome foreign nature. 1 *Breathing (taking in)*

This life process reveals the activity the living organism must develop to take in the environment and make it its own, be it solid or liquid foods, the air we breathe, warmth or cold, etc. Whenever the environment enters into the organism by force - in injuries, burns, poisoning - this overcomes the *intake* process activity. Infection following external injury prevents intake, but human receptivity for the agents responsible for cyclic infectious diseases has the "intake" activity as a precondition for such diseases. 2 *Warming (adapting)*

Here, the organism's activity makes qualitative changes in all forces coming from the outside world. Foods are actively changed. The organism initially uses tools that can be physically defined, with the configuration of the food destroyed by chewing, shaped into boles for swallowing, liquefied with the help of saliva and other secretions, with the temperature actively adapted to that of the inner organism by warming or cooling the food. A similar quality of active adaptation is seen in the widening and narrowing of the pupil to adapt the degree of light to the organism.

1 Nutrition (repelling, analysing, destroying)

In the third stage, the characteristics of environmental factors are pushed back even further and completely overcome. The organism uses chemical agents to break down the inner qualities of substances. Foods are broken down in the gastrointestinal tract with the aid of acids and bases, enzymes and, finally, immunoglobulins and cells. The foreign nature of the food is completely overcome, which is the precondition for interiorization.

In the eye, light still destroys the visual purple but is then completely absorbed and extinguished in qualitative terms in the pigment layer. Here the same life process is used to repel the light.

Acids, enzymes and immunoglobulins are used to degrade foreign organisms in inflammatory processes. This is the same process again, though in a different site and with different tools.

As the polar opposite to these three activities directed against the foreign environment, the organism generates three life processes that enable it to take an active part in the outside world. This is most clearly apparent in the 7th life process.

7 Reproduction (renewing)

The reproductive process causes a new organism to mature and be born. A new organism is created within the organism, becoming progressively more alien, and born into the world. Producing a child calls for a maximum of anabolic powers. In spatial terms, this process is the polar opposite of the first, the intake process. This was from outside in; *reproduction* is always

from inside out. Complete renewal of the organism itself within a 7-year period also reflects this life process of reproduction.

6 *Growth (growing)*

The life process of *growing* is a second building-up process. It comes to expression not only in enlargement but particularly in progressive improvement in all organs, so that they can adequately meet environmental demands:

development of trabecular structure in bone as we come upright and there has to be load-carrying capacity, the strengthening of muscles through work, or the increase in red blood cells to adapt to high altitudes - the organism grows into the task it has been given. The life process of *growing* results in improved performance. It utilizes the weekly and the monthly rhythm.

5 *Maintenance (maintaining)*

The life process of *maintaining* can be perceived to be the weakest of the three up-building processes. No longer is a new organism created (*reproduction*), nor function improved (*growing*), but the process of maintenance enables the organism to regain the quality and quantity that existed prior to degradation. The organism more or less regains its earlier performance level in sleep or during breaks from work. The process is involved in maintenance of blood sugar levels just as much as in the repolarization of action potentials: all short-term building-up processes, including night-time sleep are maintenance processes.

4 *Separation (separating)*

The middle one of the life processes, *separation*, is hardest to characterize. Secretion of saliva, gastric juice, etc. creates tools for the life processes of *adapting* and *destroying*. Saliva with a high enzyme level is the tool for bread digestion, saliva rich in mucin deals with the milk that is our food, the sweat on our skin permits *adaptation* to high outside temperatures. The process of *separation* provides the necessary tools for these life processes that break down foreign nature directed to the environment.

In a similar way, hormones are secreted as a tool for the building-up processes of *maintenance*, *growing* and *renewal*. Between these inward-directed glandular activities and those

directed outward, which we mentioned earlier, the main function of the secretory process is to build up the mineral and fluid food units step by step to become human substance. Steiner characterized this building-up stream to the effect that substances come qualitatively alive in the sphere of lung and heart, with carbon dioxide exhaled.

In the sphere of kidneys and nerves, substance grows able to facilitate processes that sustain the soul, with elimination of urine a correlated process.

In a final stage, the substance is in the field of tension between liver and sense organs and ready to be taken hold of and configured by the human I. Elimination of bile is the process going to the outside. This gradual refinement of matter in the human being is always happening in the blood. With the aid of the blood, food units are taken hold of in the intestine and metamorphosed into living body substance sustaining the soul principle and responding to the I. This ascending metamorphosis is matched by descending, eliminatory activity producing excretions. Blood is thus the key organ for *separation*, holding the middle position among the life processes. It provides tools for acting outwards against the foreign nature of the environment and, on the other hand, tools for acting inwards in building up the body. It "potentizes" substances in the human being, taking them from their ponderable state to live quality, a state where they become vehicles for soul and spirit.

Considering the blood against this background, it is immediately apparent that the life processes active in the different blood functions are vastly different.

Let us take the transport/inhibitory function. The blood takes up substances in infinitely many sites. In the lung it is most open to the environment, taking in air. In the organism it takes up substances everywhere. This intake is only possible because all the different substances are immediately wrapped up, so that they will not react according to their inherent nature, which only comes into play again when the blood lets go of the substances, separating them out - oxygen in the tissues, transferrin iron in the bone marrow, carbohydrates in the liver, etc. The

maintenance and *growth* function of the blood takes effect in liver and bone marrow, not in the blood itself. Nor do we find *adaptation* and *repulsion* processes in the blood that might affect the blood itself. The inhibitory/transport function involves only the first (*intake*) and fourth (*separation*) life processes.

The coagulation system serves to maintain the surface areas of the organism to keep inner and outer worlds apart. The system is activated when an injury has occurred. The *adaptation* process comes into play as viscosity changes, with fibrin hardened. It does not go against the environment but lets the vitality of the blood be frozen to a point where maintenance of the whole is assured. This, the second process, is activated so that the fifth (*maintenance*) may come into action.

The system of nonspecific inflammation in the organism becomes active when foreign life has entered into the organism or tissues and been destroyed. Pathogens enter without active involvement of the organism. As local inflammation develops, the blood slows down and grows denser, changing its pH (*adaptation*), granulocytes migrate to the site and provide tools for chemical destruction of the pathogens. Apart from the *adaptation* process, this also involves *repulsion*. The goal of the inflammatory process is once again maintenance of the organism's integrity. No new ability (*growth*) is gained. The organism uses the second and third life processes (*adaptation and repulsion*) to safeguard the fifth (*maintenance*).

The organism uses additional life processes in specific inflammations. Specific infection is not merely a passive process. Hoering writes: "Susceptibility, being species-related, is in the first place something quantitative. The host either has the capacity to provide accommodation for the live guest or he does not." Susceptibility or lack of susceptibility to a particular infection reflects the power of the organism to receive the infectious agent or not to receive it. Once an infection has "taken" (*intake*) *adaptation* or *repulsion* processes are activated in the first stage. These are not in the site of infection, as in the case of local infections, but after generalization in the RES and then manifest in another organ (organ manifestation). Numerous *intake* and *separation* processes are required in between, until

the maintenance process and the *growth* process take effect in the healing stage. Developing a specific immunity, the organism grows into a new capacity. (I am unable to say if the *renewal* process is also involved in recovery from an acute cyclic infection. I do not have enough criteria to differentiate clearly between *renewal* and *growth*.) In a process of specific inflammation, the organism uses the first, second and third life processes (*intake, adaptation, repulsion*) and achieves a new state of health through the fifth and sixth (*maintenance, growth*).

VII Blood as the instrument of the I-organization

Below, the ordering system given for the blood will be considered in the light of additional findings from the science of the spirit. In his lectures on Occult Physiology, Steiner spoke of how the physiological composition of the blood changes when one goes through inner schooling (macrocosmic or microcosmic). He emphasized that the blood has a dual relationship to the environment.

On one hand, the blood only enters into relationship with the outside world in such a way that anything it receives from it has been stripped of its own inherent laws; on the other hand, it enters into a relationship that enables it to approach the outside world directly. This happens when the blood flows through the lung and comes in contact with the outside air. It is then quickened by the oxygen from the outside air and configured in such a way that nothing comes up against this configuration to weaken it; the oxygen from the air does indeed approach the instrument of the human I in a way wholly in accord with the essential nature of the I.

Substances brought to the blood from below, through nutrition, must be carefully filtered so that nothing of their outside world character takes effect in the blood. In the lung, however, air from outside the human being comes to the blood directly (*intake*). The foreign nature of the air is only adapted to the organism by actively changing its humidity and temperature (*adaptation*). The foreign character of foods is changed in the upper gastrointestinal tract to remove all inherent laws from proteins, fats and carbohydrates. The inherent nature of metals needs to be specifically inhibited and covered over in the

blood. The two ways of relating to the environment - openness to the environment in the Sal pole of the blood (red blood cells) and the shrouding of substance processes in the Sulfur pole - are polar opposites in the transport system of the blood, like positive and negative electricity.

In a later lecture, Steiner differentiated the activity of the human I into thinking, feeling and will intent and described the effects these had on the blood (27 March 1911):

You will never hear those who base themselves on true occultism contradict the statement that with all these processes, which occur in our inner life in waking, day-time consciousness and fall into the category of processes connected with thinking, feeling or will impulses, truly affect material processes - live or other - in the organism, so that we are able to find material processes in the organism that correspond to everything that happens in the soul.

He went on to say that with thinking, a subtle salting-out process occurs mainly in the nerves but also in the blood, comparing it to crystals forming in a saturated solution:

The process of thinking is like a process of depositing salts due to an activity of the blood and, in turn, causing irritation of the nervous system; an organic process, therefore, that occurs on the border of the blood and of the nervous system... We know now that everything we have called conscious thinking activity, brought about by the I, comes to expression in a kind of extremely subtle salt deposition in the blood.

If we ask ourselves in which area of the blood this process takes place, attention focuses on substances such as calcium and magnesium which are partly ionized and in solution and partly withdrawn from specific ionic function, which has outside world qualities, by being hidden in albumin or other inhibitory proteins. A specific amount of free calcium ions must be present in the serum to make normal consciousness possible. We cannot, of course, expect complete crystallization in the blood, but the ionic state is the precondition for and, hence, the first step towards crystallization. We cannot be sure if Steiner was referring to this

release of blood salts from the enveloping proteins when he spoke of the physiological effects of thinking. Nor has the significance of anions been considered. The free blood salts do, however, come closest to the process of crystallizing out in the blood.

In the same lecture, substantial changes in the blood are also described for feeling:

The thinking process involves solid, salt-like principles being withdrawn from a fluid principle and being deposited. Feeling has to do with some particles in the blood changing from a more fluid to a denser state. The substance itself assume a denser condition due to coagulation.

A kind of blood coagulation is given as an image for feeling, characterizing the processes at the substantial level. A bit later Steiner compared the effect feeling has on the blood with the coagulation of liquid protein. We are not in the habit of considering feeling in conjunction with the coagulation system, with the different viscosity of protein in the blood. It is remarkable that in the ordering system of the blood under discussion the coagulation system follows on from the inhibitory/transport system just as feeling follows thinking in the order of soul processes. Steiner then went on to relate will impulses to warmth processes in the blood. He spoke of the vital influences powers of soul have on the blood when they come into effect.

We now need to take some elements from another lecture, before going back to the Prague lectures. In a lecture given to doctors on 7 January 1924 (GA 316), Steiner spoke of the effect powers of soul have during embryonic development. Powers of thought, not yet individualized, make the bones crystallize out from living matter. Sentience (feeling) prior to birth is also referred to as a process of coagulation: blood coagulates into the mobile muscle. Will impulses as courage to act, courage before action is taken, create temperature differentiations before birth and hence the form and configuration of internal organs. The will that performs the action reveals itself in temperature differentiations in bodily development that are connected with

the functions of organs. In both lectures, the crystallizing and coagulating processes are presented as running parallel to thinking and feeling respectively - in organ development before birth (bone and muscle) and in the way the soul uses the body (crystallizing and coagulation in the blood). In Occult Physiology (27 March 1911), the influence of the will on the body is described in a uniform way:

The physical process that corresponds to our will impulses is a kind of warming process causing a rise of temperature in the organism, letting it grow hot, as it were, in a certain respect. As this process is closely bound up with the whole pulsation of the blood, we may say that will impulses are connected with a rise in blood temperature.

Any will impulse changes the temperature system of warmth shell and core in a specific way. The physiology of the temperature process that goes with every will impulse and of the generation of heat with every movement is well established. We are not in the habit of seeing this as tracks left by the will. The same temperature phenomena are pathological if there is inflammation. Will activity is revealed in the stages of pus development with its local (nonspecific) inflammation. A hot abscess develops quickly and then heals. A cold abscess persists for a long time; the organism does not have enough healing powers of will. These are the extremes of local inflammation. The heal activity of tire will gains a new quality with specific inflammations such as acute cyclic infectious diseases where febrile reactions follow a strict time sequence. These are mainly childhood diseases and are inevitably connected with the functions of the specific immune system. The temperature curve reflects the disease-specific activity of the I-will in overcoming the disease and finally recovery (27 March 1920).

This duality of temperature processes can be related to the duality of courage to will and will-determined action; here the local increases in temperature seen with nonspecific infections correspond to will prior to action, and the changes in the relationship of warmth core and periphery with cyclic febrile conditions to I-determined action.

We see that, in the ordering system for blood proteins, thinking may be reflected in the forming of salts, feeling in the coagulation of proteins, and will impulses in differentiated temperature processes. All these processes involve the degradation of vitality, and there must be counter processes to ensure *maintenance*. The balances created between shrouding and release of salts, coagulation and fibrinolysis, activators and inhibitors of inflammation create the conditions under which the I can come to realization in thinking, feeling and taking action.

In addition to soul processes that appear as catabolism at the physiological level, Steiner also spoke of biological processes in his Prague series of lectures that take effect because of the influence of prebirth soul powers in anabolism. In GA 316 they were said to be osteogenesis, myogenesis and the double warmth order. He spoke of them also in his *Occult Physiology* (27 March 1911):

The conscious I organization influences the human being from one side, the unconscious I organization from the other... . Whilst the blood, inwardly quick and mobile, follows the activity of the I as an adaptable tool, the other pole, the skeletal system, withdraws from the I's active mobility to such effect that the I has no conscious awareness of everything that happens in the skeletal system, i.e. that all processes in the skeletal system are entirely beneath the surface of the I occurrences that are actually conscious. Those processes are in accord with our I activity, but they are as dead as our blood processes are live; they are therefore essentially part of the processes of which the I has no conscious awareness, and which only rise in stages from the unconscious to the conscious level. If we take a detailed look at the skeletal system in its overall function in the human organism, we have to note that it withdraws everywhere from conscious life, and most of all from all organ systems.

With the dead skeletal system, special emphasis is put on the configuration of the whole organism. These unconscious soul processes, which also act on the blood, are not accessible to our intentions but depend on the macrocosm and are mainly active prior to birth.

Whereas these solid inclusions in conscious life, i.e. in thinking, come to expression in the blood in a kind of mobile, active salt deposition process, the principle preparing the I comes to expression in the skeletal system in such a way that the macrocosm creates our skeletal system so that it consists largely of deposited salts. These are the resting element in us, the other, opposite pole to the highly active processes in the salt deposition processes in the blood. As human beings we are thus made thinkers in processes coming from two sides - unconsciously on one side, as our skeletal system develops, and consciously on the other, going through the same processes in full consciousness that in the organism present as the deposition processes of which we are able to say that they are inwardly active. The salts produced as we think must immediately be dissolved again and removed through sleep.

For conscious thinking, we use the kind of salt production processes that have their model in the release of calcium from albumin and are always reversible. Steiner relates salt deposition in the skeleton to the cosmic thinking in us of which we are not conscious. The tremendous metamorphosis of bone, cartilage and regular connective tissue on one hand, and reticular connective tissue, reticular organs (RES) and blood on the other cannot be discussed here. This greater polarity between blood and bone is reflected within the blood in the lesser polarity between inhibitory/transport proteins and red blood cells. The latter represent the Sal process in the blood just as the bones do in the greater system outlined. Permanent deposition of salts in the bones metamorphoses into deposition of hemoglobin in the red cells. These cells are much more advanced towards death than bones are. Their shape is also a purer reflection of the spherical form of the macrocosm. The unconscious, macrocosmic thinking process, the world thinking in us, comes to expression in bone salts, and in metamorphosed form in the red blood cells.

In the same lecture course, Steiner also refers to an unconscious macro-cosmic feeling process. Prebirth feeling makes the protein form of the bone coagulate just as prebirth thinking causes salts to be deposited in bones. In GA 316, these organ-generating feeling processes are referred to as "coagulation to form muscle," here as coagulation into gelatin. Both have in common that

proteins condense to an insoluble form, the image of coagulation.

Finally, Steiner also spoke in the Prague lectures of a macrocosmic process of will impulses, a process acting upwards from below in us and deeply unconscious in body creation.

Compounds that form, which we may call products of inner combustion processes, inner oxidation processes, are to be found everywhere in the organism. Insofar as they are below the threshold of consciousness and have nothing to do with conscious life, they belong to the opposite pole on the other side, which is closed off from anything that can influence conscious life.

The effect of a conscious inner life that is open to the surrounding world is reflected in the protein or Sulfur side of the blood. Here a constant change between salting out and shrouding, activation and inhibition of coagulation and inflammatory processes can be seen in the substances. The rapid changes in the inner life correlate with these rapid substance processes that are always balanced out again by counter processes. The action of the unconscious macrocosm's soul processes, which are also called thinking, feeling and will intent, is in bodily terms reflected on the cellular, the Sal side.

The side where the blood is open and alive to the environment is closed to the conscious soul processes and vice versa.

If we consider this, the blood will indeed be full of significance for us, presenting as a very special fluid for, on one hand, the blood shows its essential nature as turning to the lowest, humblest realm below us, showing itself to be a form of matter capable of external chemical processes (i.e. O₂ uptake; HBvL) so that it may be an instrument for the I. On the other hand, blood is the substance that is more protected, to enable it to achieve inward processes that cannot be achieved anywhere else for all other organ processes are necessary for this. The most subtle processes of the highest order that are stimulated from the depth of our organism combine in the blood with physical and chemical processes of the kind we see all around us in the world. In no other substance does the physical, material world we perceive through the senses come together so directly, demanding the

presence, the activity of systems of forces that lie outside the sense-perceptible world - but only in our blood substance.

The Goethean ordering system for the blood and the spiritual laws illuminate one another. The cellular aspect opens the blood to the (unconscious) environment and is the instrument for an unconscious, macrocosmic inner life. The serum aspect shuts itself off from the processes of the material environment, enveloping the imponderables connected with the environment, which makes it the instrument for an independent, conscious inner life. At first sight, it may seem surprising to speak of the higher, conscious inner activity that uses the body as related to the lower blood processes which are open to metabolism and, conversely, see the body-creating, sleeping inner activity as the basis of the aspect in the blood that is open to the environment. It reflects the polarity of life processes and soul processes, a polarity we find again and again. We perceive the archetype of the I organization in the organism - processes going in opposite directions are held in balance, thus creating the conditions for further development.

VIII The blood as 'embryonic' and 'image' organ

Considering the individual elements of the blood within the proposed ordering system, we have so far seen progressive devitalization of cell elements (from the lymphocytes, which are close to the stem cells, to the old granulocytes, anuclear thrombocytes and finally red blood cells, which are anuclear and contain little plasma), representing the Sal pole, and the system of blood proteins (specific and nonspecific inflammatory proteins, coagulation proteins and inhibitory/transport proteins) representing the Sulfur pole. For the latter, an attempt was made to present the metamorphosis from ionized salts to albumin as the general enveloping protein and the specialized inhibitory/transport proteins. In shrouding the metals, which in themselves are toxic, the system reaches its Sulfur pole. This was characterized by the quality of "formless dissolution" and "interiorization of imponderables," just as the Sal pole was seen to show "dying into form" and "openness to outside world influences."

Another ordering system to be considered is the metamorphosis

of blood elements from those that are close to the stem cells and therefore embryonic, and those that need a long process of development to be functionally mature. In a lecture given on 29 October 1921 (GA 208), Steiner spoke of the quality of *image* and *embryonic* organs. Embryonic here refers to all organs and parts of organs that stay close to their original state in embryonic development. They do not go through many form processes or stages of differentiation. The polar opposite to this are *image* organs, which go through a long process of development to become functionally mature, in our system, the three-stage development of red blood cells strikes us as remarkable. Nucleated pro-erythroblasts with HbG during extra-embryonic hemopoiesis, fetal anuclear red cells with HbF, and only then the adult red cells. This three-stage metamorphosis is consecutive, with hemopoiesis becoming more and more open to the environment, and showing increasing functional quality. This recalls the three-stage development of the long bones, which have the same mesenchymal origin as the blood.

The blood proteins - albumin - also have at least two stages of development, with fetal AFP the precursor of adult albumin. (We can be quite certain that there must be another blood protein during the early embryonic period.) Both the sulfuric blood protein and the red cells with their fixed form thus need a long developmental process, they are *image* organs. The I organization shows itself as a thinking process in both aspects, in the red blood cells as image of prebirth thinking, in the production of salts and release of albumin as image of awake, conscious thinking. Steiner characterized the middle principle in this system, polar to the image organs, as "organically materially young," "not getting old." In this, he said, the human will can develop:

The will end of man is an organic development that has not come to completion... What is organic development that has not come to completion? An embryo, for this can develop further.

In the blood organ, we see this embryonic life in the immune system which is capable of development, remaining open to future organic development with its learning capacity. Recently, lymphoid bone marrow stem cells have also been found in the

blood. These put even greater emphasis on the embryonic aspect. These embryonic organic spheres are necessary if there is to be future development. In fact, speaking in terms of substance, they provide the potential for a further incarnation. Throughout the organism, we have image organs with sequential metamorphoses, and these always show the connection with life that has become physical reality, and we find *embryonic* organs that provide the potential for the will. The relationship between immune system and will intent was inferred from the sequence of elements crystallizing out - coagulating - warming in the earlier part. The same relationship between functional systems in the blood and soul qualities emerges where we have taken quite a different route. The image organs at either pole of the system need a long developmental process before they are wholly the image of creative power. Only then will they serve the nerves and senses in sensory perception and thinking. The embryonic elements serve the will because developmental potential persists at the organic level that has not yet come to full development.

This vital experience in matter (in the *embryonic* organs) does not allow consciousness to arise. This, however, makes it possible for us to develop the will, so that we destroy matter here (image organs), but retain seeds here, when matter drops away at death, seeds that hold the potential for the earth lives to come.

IX The aspects of the human being in the blood organ

So far, we gained new indications for the Sal - Mercury - Sulfur order of the world, for the image and embryonic nature of the organism, and discovered the influence soul processes have on the blood organ. Again and again we refer to the lectures on *Occult Physiology*. Here, Sterner also spoke of the physiological effects of the aspects of the human being. The blood as a whole may be the organ of the I organization, but the whole human being must also be reflected in it:

In this blood system... we have to see the physical instrument of our I. We know that our I... has as its foundation a physical body, an ether body and an astral body.... As this I presupposes those three aspects of the human being in spiritual terms, so its physical organ, the blood system, presupposes such images of

the astral and the etheric body in physical terms. (23 March 1911)

A little later, reference is also made to a process that is below the sphere of life:

We descend from the life processes to processes of the inherently physical when the food substances we have taken in are transported to many different parts of the physical body.

Reference is thus made to the inhibitory/transport system in the blood. This comes closest to reflecting the physical body in the blood. Its function lies in its ability to flow, its buffering quality, and the ability to take up substances and release them. It is remarkable that these functions become possible through the combined actions of blood cells and serum. We remember: red cells provide 88% of the buffer capacity of the blood. The synchronous coexistence of cells and fluid provides for the special flow capacity, for transport and inhibition.

The coagulation function arises in a different way. Concurrent coexistence of humoral and cellular parts is inhibited, remaining mere potential up to the moment of injury. Then a cascade-type sequence begins. In strict order, the coagulation process evolves consecutively step by step; the counter processes begin at the same time, but also are consecutive. Concurrent coexistence is abandoned, with a strict sequence taking over. The goal of the process is *maintenance* of the organism, healing of the injured surface. No living organism can exist unless there are limits set in both processes and space. On the microscopic scale, we see the cell membranes, the lysosomes, etc.; on the macroscopic scale, the skin surface, which marks both living openness and outer limit. The coagulation system of the blood with its surface-preserving function and its sequential processes may thus be seen as a reflection of the ether body in the blood.

In the complement system of local inflammation, the *sequential* nature of individual processes is similar to that seen in the coagulation system. At the same time, granulocytes and monocytes secrete cytokines. Here, the purely sequential order is abandoned. The function of this nonspecific inflammatory system

is to kill foreign life in the organism and remove it through pus. Increased mobility, phagocytosis, elimination of inorganic and organic poisons point to activities under the control of the human astral body. This, then, is where the astral body is reflected in the blood.

In the specific immune system it has so far been only possible, with some effort, to establish the strict sequence of some processes. Reference is made to a network of *interconnected* processes. Every individual process is also counter-process to another. In the coagulation system the tools for activation and inhibition are clearly distinct. In the concerted effort of immunization there are no separate "helper" and "suppressor" cells, but every individual process is both at the same time. Every new infection results in a new imprint, new immunization. This learning process bases on the embryonic part of the blood. Our I organization brings order into the *concerted* effort. We are thus able to see how the four aspects of the human being leave their imprint in the four basic functions of the blood.

X Prospect

In no other substance does the physical, sense-perceptible, material world encounter another, inner world that presupposes the existence and function of systems of forces beyond sensory perception as directly as it does in our blood substance. (27 March 1911)

An attempt has been made to show the relationship between the fourfold order of the blood with its four basic physiological systems and the aspects of the essential human being:

The specific inflammatory system as the instrument of I activity in the blood, with processes acting in concert.

The nonspecific inflammatory system as the instrument of soul activity in the blood, with processes both in concert and consecutive.

The coagulation system as the instrument of the ether body in the blood, with processes in sequence.

The inhibitory/transport system as the instrument of the physical body in the blood, with processes concurrent.

In this ordering system both individual and macrocosmic prebirth activity shine out in thinking, feeling and will intent. We thus discover the *threefold* order of the blood, which reveals the Sal - Mercury - Sulfur forces with their configuring and process-ordering activities. The twofold order of the blood between the more *embryonic*, live lymph system and the *image* organs which develop through a sequence of metamorphoses, showed relationship to past and future.

An attempt was also made to describe the sevenfold activity of life processes in the blood. The unbelievably differentiated nature of the blood, which as a whole is an organ of the I, was thus beginning to emerge. In the daily routine of medical work, blood tests play an important role in diagnosis and choice of treatment. So far, it has not been realized that every change in the blood necessarily also means a change in soul processes.

Frequent reference has been made to the lectures on *Occult Physiology* where the spiritual scientist spoke of a further step: changes in the blood through schooling. In many passages he described the two routes from habitual life in sensory perception and awareness to the world beyond the sphere of the senses. These passages are presented in detail in the lectures on *Macrocosm and Microcosm* (GA 119). In *Occult Physiology*, Steiner spoke of the physiological changes that come with occult training. Training in coming awake, into the body, into mystic life, leads to a form of clairvoyance that is connected with the body-creating forces of the lower human being. Substance processes change on the Sal side when one enters deeply into the mystic realm (22 March 1911):

The blood would thus be able to receive radiations, influences, as it were, from the internal organs and would... as instrument of the I bring the inner life of these organs to expression in this I... This inner absorption, this... mystic path is... such that we do not withdraw the instrument of the I, the blood, from the nerve, but rather push it further into the sympathetic nervous system. The other schooling path makes it possible to release the nerves of

the brain and spinal marrow from the blood through concentration of thoughts, through concentration of feelings, through occult schooling.

Here, reference is made to the macrocosmic schooling path that reveals itself on going to sleep and is activated by concentrating one's thoughts, by using the will to practice this. We remember: normal conscious awareness depends on the ability to use the inorganic salts on the Sulfur side of the blood. In several lectures (e.g. 15 Oct. 1923, GA 229), Steiner said that in the future, when supersensible consciousness has been developed, iron might assume a similar function to that of calcium and magnesium in present-day consciousness.

We are not in the habit of thinking of the soul processes - thinking, feeling and will intent - in conjunction with physiological changes in the blood capable of scientific analysis. We are even less aware of the soul processes coming to expression in pathologically changed parameters. The vast number of known changes in the blood might become the revelation of unconscious soul qualities in every case of illness. It is characteristic of cancer that typical changes in the blood are seen very late. A particular mystery in this respect are the tumor markers, for they should only have a physical and a soul function during the embryonic period. CEA shrouds the blood salts much more strongly than does albumin. The soul should not yet be in a waking state during the embryonic period. It will be possible to infer changed soul functions of patients with high CEA levels if we have better knowledge of the physiological function of these proteins during the embryonic period. We use mistletoe treatment to effect changes in the blood organism. The term "immunomodulation" points to the problematical nature of this. Agreement has not been reached to date as to which changes in blood parameters indicate optimum *Viscum* dosage in long-term treatment, or how over- or underdosage may be assessed. The ordering system of the blood presented in this paper arose from the endeavor to gain better understanding both of the study of man in cancer and of treatment.

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