



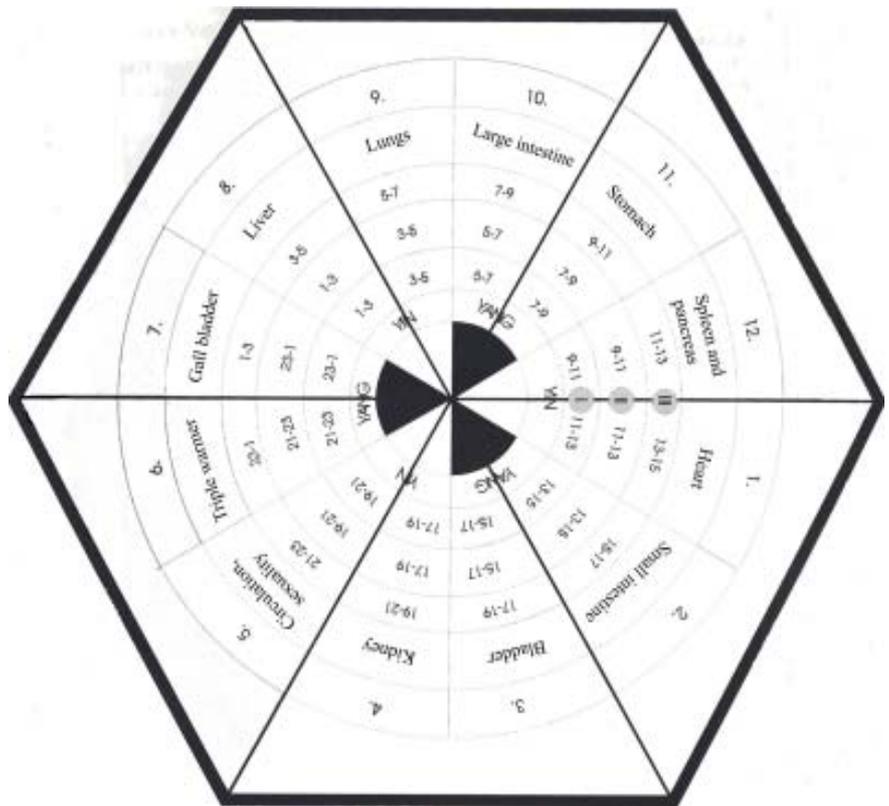
Circadian rhythms in the acid-base metabolism and their significance for the practice

by Dr Anita Kracke

There is an oscillating rhythm to our lives, and everywhere around us we can observe rhythmic time patterns. The word “rhythm“ is derived from the Greek word “rheo“, meaning a flow or pattern of movement. It therefore implies forms and shapes which are developing. What we understand today as rhythm was described in ancient India as “life shrouded in movement“. That can only mean that we as individuals have a distinctive pattern of oscillation.

The natural time programmes of the universe control the timing of all life processes, and all the life processes which are known from biomedicine – some of which can also be measured – are based on adjustments to this. Since the awakening of mankind, the cyclical changes in heaven and earth have left their mark on the way our ancestors experienced time. The wheel symbolises that which returns again and again. We perceive the sun as a disk and our children draw it as a circle. Our ancestors had their gods thundering their way across the sky in fiery chariots with glowing wheels and honoured their gods with sun wheels. The circular charts of eastern medicine, the organ clock (Illus.1) and even the flower clock invented by Linné and cuckoo clocks show the significance and universality of such rhythms.

Rhythmic patterns like this can be measured. But the ability to measure them is also limited if the changes are spread over a period of years or are at higher frequencies. The processes which are played out at medium frequencies can be measured most easily: frequency of respiration, pulse, eating and



Illus. 1: Organ clock from “Ganzheitlich und naturheilkundlich orientierte Zahnmedizin“ [Holistic dentistry based on natural healing methods] by Chr. Kobau.

digestion. The most impressive must be our 24-hour rhythm of sleeping and waking. However, as our daily consciousness is switched off from time to time, this rhythm is really only experienced fully consciously when our sleep pattern is disturbed.

Phylogeneticists distinguish between different orders of rhythms:

1. In plants long-wave rhythms predominate over short-wave rhythms. Plants thus do not have so many autonomous characteristics. These plant rhythms can stretch over several years: if we consider cereals, for example, the rhythms can be suspended for centuries. As soon as the grains are brought into suitable temperatures and encounter water, the process of

germination and the growth phase will begin.

2. Animals exhibit rhythms which are developed to a higher level, with a corresponding increase in autonomy. Here too it is possible for there to be what are apparently resting periods in development. So, for example, there is an American cicada which lies hidden in holes in the earth for 17 years. Then suddenly thousands can appear within the space of 20 minutes; the cicadas mate; the eggs are laid under the bark of a tree and the adult insects drop down dead.
3. Human beings are able to detach themselves from the rhythmic order of the environment. This



results in powerful emancipation in terms of time. It is possible to achieve distinct autonomy accompanied by a weakening of the effect of the interval timer in the long-wave range.

Interval generators for biological rhythms

The long-wave clock generators are mostly hormones, whilst the shorter rhythms are more often membrane processes controlled by the nerves.

In the clock generator for rhythms it is possible to differentiate between exo-rhythms, exo-endo-rhythms and endo-rhythms.

1. Exo-rhythms

Geophysical conditions are the exogenic timing generators which determine rhythms in the long-wave range. So, for example, compass plants arrange their leaves and sunflowers turn their heads according to the direction of the sun. Birds sing or fall silent according to a particular level of daylight being reached. The activity of sunspots which is based on an interval of 111/8 years has a quite considerable influence on the rhythm of plants, animals and human beings.

The movement of the sun and the moon over the course of the year determines the reproductive rhythms of all living things, and growth in plants and animals depends on the length and intensity of daylight, in the first instance without taking other provisions into consideration.

2. Exo-endo-rhythms

Exo-endo-rhythms are rhythms which are determined by geophysics

but synchronised as a result of environmental clocks. Constant adjustments must be made. This can be established particularly well in the so-called circadian rhythms in human beings. Back in the 18th century De Mairan discovered that heliotrope flowers will follow exactly the same time rhythm in a totally blacked-out room as they do outdoors in sunlight. Even in a darkened room they turn their heads to face the sun exactly. In the 1960s Aschoff conducted the same experiment with people, taking them to an underground bunker and cutting them off completely from the outside world. Food was delivered via a double-door system, and no other information was provided. Some people stayed there for up to 86 days. It showed what had always been supposed: for example, that there is a daily rhythm of the body temperature, digestion and other organ activity. But our pre-determined time clock (the exogenic interval) is based on a period of almost 25 hours. This means that the people in the bunker adjusted even after a short time to a 25-hour day. As a result, after they came out, they had lost a whole “normal“ 24-hour day for every 24 days they had spent in the bunker. In general, for us this means that our 24-hour day only becomes a normal day for our bodily rhythms because we keep resynchronising it. Therefore because some of our bodily rhythms do not correspond exactly to a 24-hour day, the expression “circadian rhythm“ was coined.

There are other rhythms too which occur at intervals of 3 to 4 days or a week or one revolution of the moon (the lunar fertility cycle in women) or – if they last a year –

are referred to as circannual rhythms.

The ability to synchronise such bodily rhythms is extremely important, for by doing so we are able to bring forward the new beginning of our internal day. It would be difficult, even impossible, to adapt if our inner rhythm ran faster than the solar day: We would have already reached the end of our day before the solar day had been completed.

3. Endo-rhythms

These are independent spontaneous rhythms which need no clock. They are coordinated with other rhythms within the organism, thereby setting up particular frequency and phasal relationships with one another. In the medium-wave range the frequencies relate to one another in terms of degree. In the short-wave range the relationships between them can be modulated to become weaker or stronger. In extreme cases the timing of the frequencies is totally different in endogenic terms.

A formal distinction can also be made between short-wave rhythms which occur as impulse-like oscillations (sawtooth or relaxation oscillations) and can exhibit abrupt changes in the curve trace, and slow oscillations which exhibit sinusoidal characteristics, are frequency-stable and can only change in amplitude.

The time ordering of life processes

Expressions of life are aimed at two goals: on the one hand the specific output of a function or organ, and



on the other hand ensuring order, continued existence and regeneration.

As both cannot be achieved at the same time, there is a time sequence controlling these processes. It is possible to observe that life processes occur alternately.

Let me explain, taking the division of cells as an example:

1. First enzymes are formed.
2. Synthesis: an exact copy of the DNA is made. This guarantees that the daughter cell contains the same inherited information. Two versions of the inherited information now exist.
3. In the resting phase which now follows the proteins begin to mature. They are the material which will decide when the cell will divide.
4. The proteins induce the last phase - cell division - in which the daughter cells appear.

This division of cells takes place in carefully determined cycles, with old cells being replaced by new ones. We are therefore continually changing. Such cell division cycles take on average 90 to 120 minutes, from the smallest microbe through algae to our cells in the macroorganism. For example, it is thanks to this cyclical process that the amount of DNA in our bodies can be increased tempo-rarily by 60 %.

The liver cycle

The first person to take an intense scientific interest in the cycle of an organ, namely the liver, was Forsgren in 1928. He discovered that our livers have a functional cycle which is of great significance for the work of the other organs and also

in particular for the regulation of the acid-base metabolism. The work of the kidneys, what happens in Pischinger's space during a day and the so-called saline circulation are closely connected to the liver cycle.

Two phases can be differentiated in the function cycle of the liver, in which the one organ function practically excludes the other. In very general terms, one may refer to the dissimilatoric (secretoric) phase of the liver in the period between 2 am and 2 pm and the assimilatoric phase in the period between 2 pm and 2 am.

Except for large lobes, in the microscopic region the liver is divided into lobules which are still just visible macroscopically at a size of 1–2 mm. The lobules are surrounded by the tissues of the so-called Glisson's capsule and so separated from one another.

Between the individual lobules run the capillaries of the Arteria hepatica [hepatic artery] which supplies the liver with arterial blood containing oxygen. Alongside this run the venous capillaries of the Venae hepaticae [hepatic veins] which take away the venous blood from the liver and finally open out into the Vena cava caudalis. In addition, bile first collects in the lymph spaces between the liver cells and then drains away between the lobules into the bile ducts which are lined with simple epithelial tissue. In the centre of liver lobule is a branch of the Vena portae which brings the venous blood from the bowels for detoxification in the liver.

This little digression into anatomy is necessary in order to understand the processes which take place in the

liver in a daily rhythm. In the period between 2 pm and 2 am, rising to a maximum at 2 am, substances – especially glycogen and proteins – are builded up in the so-called assimilatoric phase and stored in the cells of the liver. Starting from the central vein of the lobule, glucose is transformed into our “stored sugar“ glycogen. At the same time bile from the cells of the lobules is pushed out further and further towards the periphery. During this time the liver therefore has a pleasant taste, is light brown, firm, and weighs almost twice as much as at the peak of the secretoric phase. At 2 am the organ now switches to dissimilation. Also working in time with the organ clock, the main period of liver function now begins, breaking down the glycogen again in order to make it available to the body in the form of energy. Now, starting from the periphery of the lobule, the blood is increasingly detoxified, and bile and the products of dissimilation such as urea and urobilinogens are stored in the cells of the periphery of the lobule, always working towards the central vein. This phase – which reaches its maximum towards 2 pm – is called the secretoric phase of the liver. Now the liver is dark brown; it tastes bitter and feels flabby. It can also be shown that, at the same time as these things are taking place in the body, in the period between 10 pm and 6 am there is a base tide. Between 8 am and 7 pm a base flood can be observed by the physiologist; this too can be reflected in the urine measurements.

It is a known fact that patients with liver disease wake up between 1.30 and 2.30 am feeling unwell or even in pain. If we now consider that the

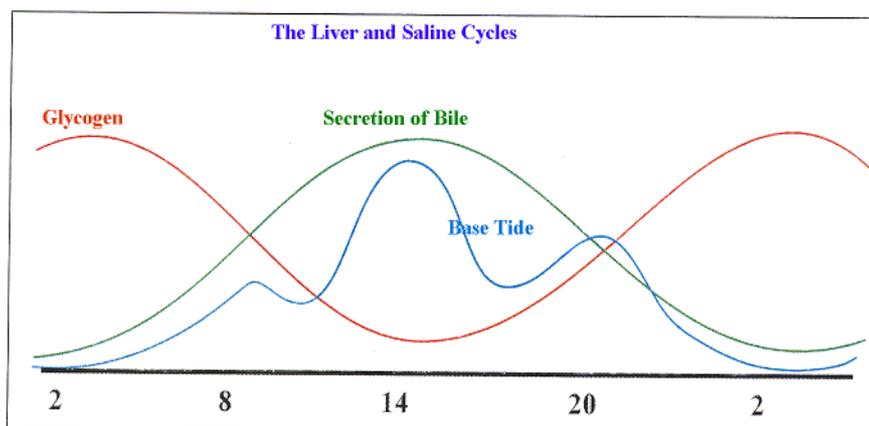
liver is an extremely basophilic organ which needs an alkaline milieu to function at its best, and also that (among other things) the toxins and bile acids produced from the reticuloendothelial system circulate in the blood, it should come as no surprise that the body reacts with a waking mechanism. The liver must, for example, have alkalines in order to neutralise the bile acids which arise during the moulting of the blood in the reticuloendothelial system. Only then can the bile salts be stored in the liver in order to be discharged via the smallest bile ducts later as and when needed. So if the patient who wakes in the night eats something, then the parietal cells lining the stomach analyse the saline and produce a base flood which enables the liver to work. The circulating acids can be buffered and stored as neutral salts together with other products of dissimilation.

The interaction between the liver and saline cycles is shown in illus. 2.

The acid base metabolism

Some 60 years ago Sander took a keen interest in the acid base metabolism. It is possible to differentiate between an absolute and relative concentration of acids and bases in the body. The relative concentration is subject to the current regulation and depends upon the absolute quantity. The pH of the blood is also an ongoing function whereby the alkaline reserves represent potential valencies which the body can fall back on during the ongoing regulation.

Acids are supplied exogenically and develop within the body.



Illus.2: The liver and saline cycles

1. The stomach produces large quantities of hydrochloric acid through the action of the parietal cells. The hydrochloric acid acts as an antiseptic, loosens bones and cartilage and prepares the protein digestive system. At the same time the breaking down of the saline produces sodium bicarbonate in the presence of water and carbon dioxide. This basic salt would lead to alkalosis if the basophilic organs of the liver, pancreas and glands of the intestinal mucous membrane (Brunner's and Lieberkühn's glands) did not immediately take up this alkali and store it.

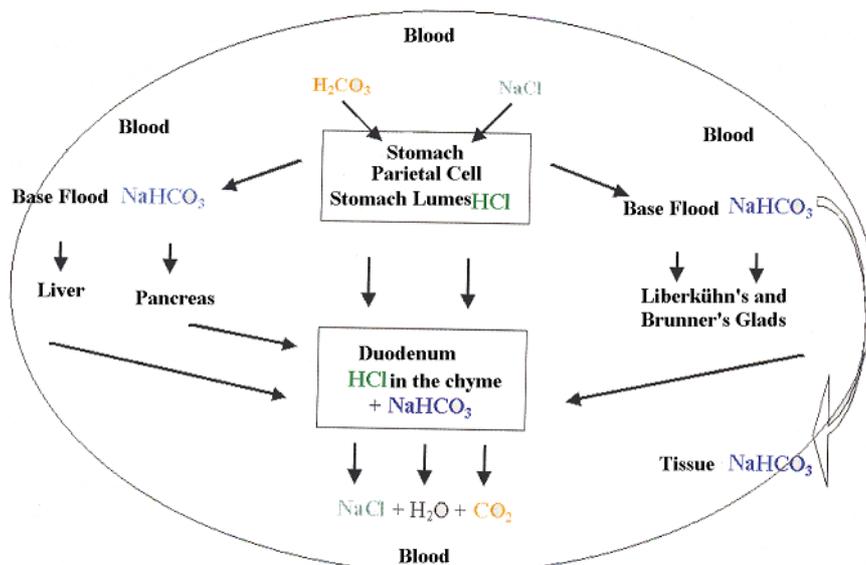
$$\text{NaCl} + \text{CO}_2 + \text{H}_2\text{O} \Leftrightarrow \text{HCl} + \text{NaHCO}_3$$
2. Many acids (e.g. lactic acid and fruit acids) are ingested through our diet, and when food is broken down, acids are formed. This is particularly so when the food is too rich in animal protein. Sulphuric acid in the form of metabolites is the result of the combustion of amino acids, oxidation of SH groups or the division of sulphide bridges, and the same applies to phosphoric acid in food which contains a lot of phosphor. These inorganic acids (sulphuric and phosphoric acid) are very strongly dissociated and the high number of protons in them causes acidosis. Therefore they are either connected to the collagen structures of the connective tissue or stored as neutral salts in the connective tissue and the liver, temporarily or permanently.
3. Chronic-intestinal fermentation allows acids to be formed e.g. from carbohydrates which cannot be broken down in the small intestine and reabsorbed.
4. Malfunction of the endocrinal glands and organs (diabetes, liver disease) also leads to excess acidity in the tissues.
5. The vegetative condition of the organism influences the acid - base metabolism very strongly; distress and sympathicotonia are the cause of intensive build-up of acid. According to Kraus all chronic diseases are almost without exception of a sympathicotonic nature
6. Extremes of physical labour and sport can lead to the formation of excess lactic acid. The lactic acid is bonded with the collagen fibres until the kidneys do their

work of detoxification and excretion.

The strongest buffers in the blood for the neutralisation of existing or additional acids are sodium bicarbonate, sodium diphosphate or monophosphate, sodium albuminate and albumen. Nevertheless this buffer power would not be sufficient in a strike against acids if the collagen substances were not available in the connective tissues to bond with the acids temporarily. This applies particularly to weak organic acids. It is less the pH-value which gives information about the buffer capability of the body than the amount of alkali reserves which are available to bond with particularly inorganic acids as they flood in. The carbonic acid which is freed up on the neutralisation of the acids in the tissue breaks down into water and carbon dioxide which can be exhaled. Therefore, if there is a good reserve of alkalis, the pH value of the tissue can be slowly raised from acidity almost to the level of the pH value of blood. The enriching of the tissue with uric acid depends on this acid being hardly soluble and therefore the other easily soluble acids are “washed out“ in the event of a base flood. Very inorganic acids must always be transported as neutral salts.

We can regard the stomach as the central organ in the acid-base metabolism. Illus. 3 shows the saline circulation.

The gastric parietal cells produce hydrochloric acid in the lumen and sodium bicarbonate in the tissues and blood. This natural basic salt is carried both through the circulation of the blood to the basophilic organs where it is stored and also



Illus. 3: The “saline circulation“

at the time of a base tide after a meal into the connective tissue in order to “flush it out“, thereby bonding with the acids which have been stored there in the meantime to form salts and transporting these to the kidneys. In a well-balanced acid-base metabolism the bonded acids (e.g. in the form of sodium salts) can be excreted. If a large number of neutral salts are formed in the “flushing out“ of the connective tissue, those salts which now require blood could lead to uraemia because the kidneys are unable to remove the toxins adequately from this high level. The salts are then stored temporarily in this organ during the secretoric phase of the liver and released again to be disposed of as and when the kidneys are able to do so. Acids themselves could not be temporarily stored by the liver.

As well as being excreted via the bicarbonate buffers, the protons can also be excreted with the help of the phosphate buffer. If there is a lack of alkalis the left-over acids are eliminated as ammonium salts by

sodium being exchanged for ammonia in the kidney cells so that it can become available to the body again following its resynthesis to sodium bicarbonate. This is effectively a saving.

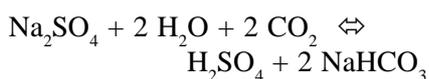


At night and when the body is subject to latent acidosis, it would only be possible to excrete acids by diffusion. In this form of metabolism the acids diffuse from the tissue into the blood. There they are converted – predominantly by buffering – into neutral salts and brought to the kidneys where they are neutralised. The basic substances are reabsorbed and the protons are actively excreted. This explains the acidity of the night urine and also a static acid of the urine in the daytime. When there is a large accumulation of protons and at the same time a dearth of basic (alkaline) substances in the body, this excretion by diffusion is the only way in which



the organism can free itself from the acid load. Here we are talking about a very slow process of disacidification which is costly in terms of energy.

This excretion of acids directly via the kidneys works according to the formula:



Night urine comes from the tissues, and if it is acid that is a sign that the tissues are being de-acidified. If the daytime urine is also constantly acid, this means that the body can only eliminate acids by diffusion. Daytime urine is normally enriched with the salts which were temporarily stored in the liver. As these are neutral salts, the urine then becomes weakly acid or alkaline. The kidneys function best when the pH of the urine has a value of 6.8.

In the course of a day base floods and base tides occur in the body, brought about on the one hand by meals and the breakdown of cooking salt in the stomach associated with this and on the other hand by digestive activity, and these can be read from the pH value of the urine.

In contrast to the acid valencies which are supplied by food or for the most part arise endogenically, basic substances have to be supplied exogenically through the diet. A lack of alkali can therefore only be balanced by adding basic substances enterally or parenterally. An imbalance in favour of the basic valencies is seldom reached. There can be alkalosis with a rise in the pH value of the blood to over 7.5

as a result of increased exhalation of CO_2 via the lungs when there is at the same time a lack of alkalines or metabolic alkalosis with excess bases as a result of excess addition of bases (bicarbonates, lactates, citrates) or constant vomiting. In vomiting, hydrochloric acid is continually being lost from the stomach and is then no longer available in the small intestine to buffer the bicarbonates.

In a normal metabolism there is no alkalosis and accordingly the body is also not set up to react to this extreme situation: in any case the pH value of the blood can be best regulated by retention of CO_2 if there is an excess of basic substances.

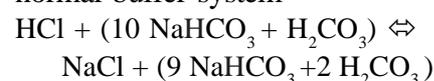
Carboanhydrasis



In this connection, the significance of the lungs for the acid-base regulation must be noted. The acid-bonding energy of the blood and the fluids in the tissue does not depend on the pH value at the time but rather on the reserves of alkalis. This means that a balance between acids and bases which is expressed in the pH value is not decisive when appraising the patient's condition but rather the potencies in the acid-base metabolism. Carbonic acid is formed during the neutralisation of acids in the tissues, and this is transported via the blood to the lungs and can be exhaled in the form of carbon dioxide and water. Where there is a good reserve of alkalis in the blood, the pH value of the blood can therefore easily be raised to levels which are about that of the physiological blood pressure value.

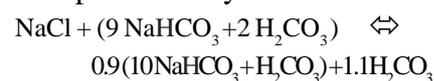
If however there is acute or latent acidosis, then the body tries to eliminate excess protons via respiration in the form of carbon dioxide and water. The pH value of the blood rises again to alkaline levels, but the fluids in the tissue are highly over-acidic because there are no proton acceptors – basic substances – to neutralise the acid in the tissues.

normal buffer system



If now the free hydrochloric acid is exhaled, this results in

disrupted buffer system



normal buffer system

exhaled carbon dioxide

After the carbon dioxide is excreted via the lungs, the alkalis reserves of the blood are reduced by 10 % and the pH value (the relationship between bases and acids) remains the same for the time being. If more acids are added the buffer reserve can be used up to such an extent that the blood becomes alkaline.

Measuring the acid-base metabolism

There are some excellent methods of measuring in order to get a picture of the acid-base metabolism. From what has already been described, it is clear that the pH value alone does not give information on the acid-base metabolism. Sander developed a urine titration method to determine the acidity quotient. Using this method it can be shown very

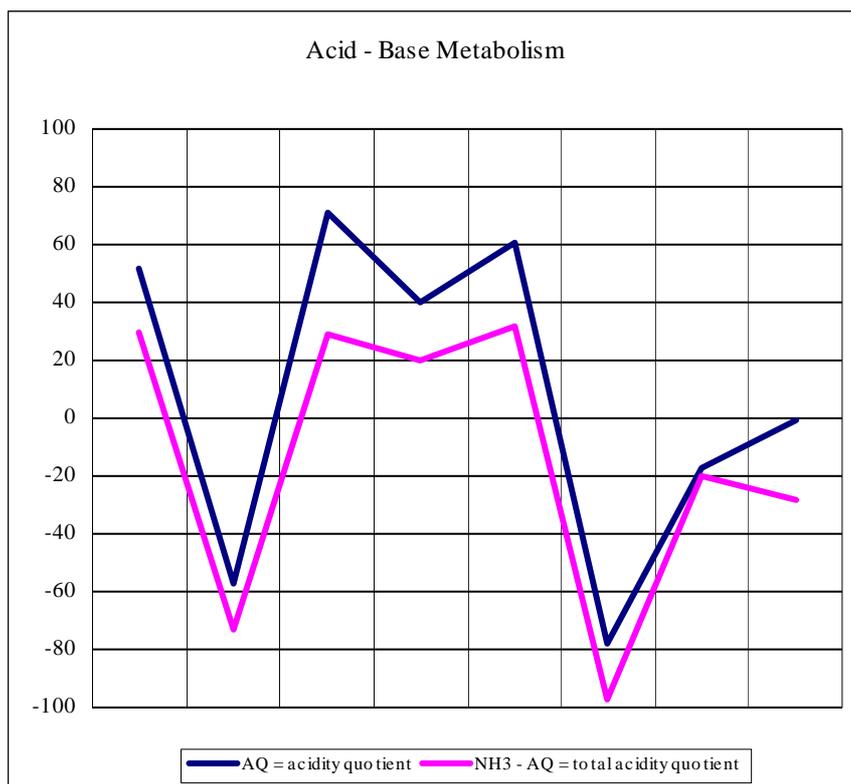
clearly whether the acid-base metabolism is balanced. The following illustration (Illus. 4a) shows the optimum daily graph of the acid-base balance according to Sander, whilst Illus. 4b shows the daily graph in a case of mesenchymal and “latent“ acidosis. The missing base floods are characteristic of “acid rigour“ (from Helmut Elmau: “Bioelektronik nach Vincent – Säure-Basen-, Wasser- und Elektrolythaushalt in Theorie und Praxis“ [*Bioelectronics according to Vincent: the acid-base, water and electrolytic metabolisms in theory and practice*], pro medicina-Verlag, 2nd edition, 2001, available from the Semmelweis publishing house).

Jörgensen measures the buffer capacity of the venous blood, the blood plasma and the pH value of the blood. With bioelectronics using Vincent’s method, three bodily fluids are measured at once: namely saliva, blood and urine. The pH value, the rH_2 value (electrical potential) and R value (specific resistance of a fluid which contains electrolytes) of these three fluids are all measured and then it is possible among other things to predict the acid-base metabolism. This method of measurement also enables other diagnoses to be made.

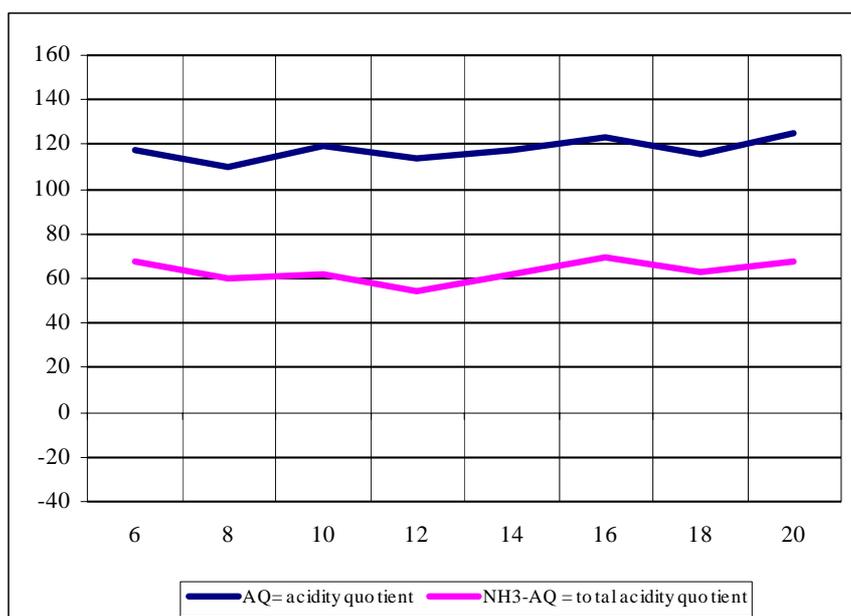
The following method has proved to be the simplest way of measuring, providing evidence relatively quickly and inexpensively. Using normal pH paper the patient makes a urine profile over a period of at least 2 - 3 days. On each occasion the measured pH value of the spontaneously produced urine is entered on a little chart which shows the time, the pH value as measured and possibly also

the food and drink consumed on this day. No time plan is prescribed as to when the patient should measure his urine, because information can be gathered regarding the volume of fluid which the patient drinks, as well as on how often micturation is necessary. The measurements are of

course – if necessary – also carried out during the night. Using these values, a table can be drawn up which shows whether the patient’s results have a rhythm according to the time of day or whether an acid rigour is present.



Illus. 4a: The optimum daily graph of the acid-base metabolism according to Sander



Illus. 4b: The daily graph in a case of mesenchymal and „latent“ acidosis



Treatment to regulate this

The acid-base metabolism can be balanced by changing the diet to that recommended by Werthmann and adding basic salts (e.g. ALKALAN and T) in a large glass of hot water in the periods when bases are particularly needed in the early morning and before going to bed at night. At the same time one would prescribe SANUVIS, the potency accord of clockwise lactic acid, and CITROKEHL, the potency accord of citric acid, in order on the one hand to encourage the formation of racemes and on the other hand to de-acidify the body by means of the organic acids. The alkalising effect of fruit acids from vegetables and fruit also depends on this. The acid remains from these weak organic acids work as proton receptors – even when prescribed therapeutically in the form of fruit salts, e.g. in ALKALAN. They are metabolised as CO_2 (which can be excreted via the lungs) and H_2O (which can either be eliminated or utilised).

In particularly acute cases of acidosis a balance can be achieved with base infusions. In patients with

disorders of the renal function, alkaline baths as whole-body, foot or arm baths are to be recommended. In certain cases infusions of alkalis may also be prescribed. Along with the change of diet, one should be thinking of basic teas (wormwood, sage, yarrow, horse-tail, birch leaf, stinging nettle) and decoctions of vegetables which can be prescribed in the form of so-called basic soups. To make these, particularly alkaline types of vegetable such as beans, courgettes, parsnips, celery and potatoes are cut up small, simmered for 15 to 20 minutes and sieved. This broth tastes particularly good if a beetroot is cooked with it and has a very deacidifying effect, partly because it provides organically bonded minerals.

Over-acidity is always a symptom of a sympathicotonic metabolism. It is therefore important to bring about a balance in the vegetativum between stress and relaxation. This includes getting enough sleep, if possible before midnight in order to support the spleen chakra. In terms of medication, the spleen can be stimulated extremely well with PINIKEHL and also the remedy

MUCEDOKEHL can regulate the vegetative nervous system. For this, 8–10 drops of PINIKEHL 5X can be prescribed to be taken before a meal, for example. PINIKEHL can also be prescribed together with SANUVIS as a drink: 8–10 drops of PINIKEHL 5X and 150 drops or 2 teaspoonfuls of SANUVIS are mixed with 1 litre of water and drunk over the course of a day. MUCEDOKEHL 4X should be prescribed in capsule form, to be taken before going to bed at night, or 8–10 drops of MUCEDOKEHL 5X can be taken before meals during the day. With MAPURIT capsules one also has the option of effecting very good deacidification of the cells inners and optimising cell respiration by improving the potential of the cell membrane. The capsules are best taken at midday during the “heart / small intestine period“.

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