

The resting membrane potential of cells and correlation with Elements of traditional Chinese philosophy

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There is well known role of acid-base balance in Medicine. And it is not a surprising as far as the body is consisting of entire spectrum of chemical elements from the periodic table. The metabolic processes were forced to use the first-born of the properties of chemical elements, but the main among them are alkalinity (the ability of chemical elements to donate own electron to other element – it is named as a donor) and acidity (ability of chemical element to capture foreign electron – it is named as an acceptor).

Such properties of chemical elements are a reflection of the universal physical laws that determine the quality of the physic and chemical interactions. This principle also stipulates the structure of the periodic table of chemical elements, where alkaline elements are located in the left side of the table, but acid elements - in the right one.

Between the left and the right sides of periodical table there are chemical elements with average acid-alkaline properties. They are bearing a certain proportion of both acidic and alkaline properties, depending on with which element they interact.

Let's see at chemicals elements which were weighed with the five phases of Traditional Chinese Medicine (TCM) in the early work of Pulse Academy "Five factors of cell's metabolism» (http://www.pulse-academy.org/en/Download:Five_Factors). On the base of accumulated data of Pulse Metabolic Analysis we can make some correction of the hypothesis outlined in the above mentioned work.

Now we will use the known acid-alkaline properties of chemical elements as an association with the five phases of the TCM to draw the formal structure of living cells in general:

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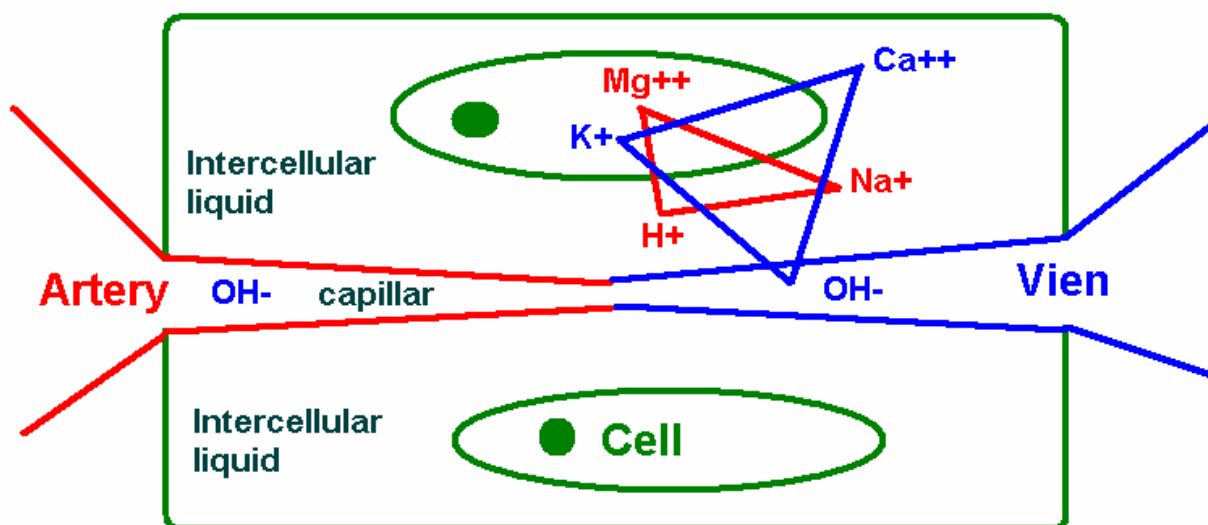


Fig. 1

As it is shown at Fig. 1, the chemical elements are divided into acidic (red) and alkaline ions (blue). They should maintain the acid - base balance:

The volume of the acid-alkaline potentials of K^+ , Mg^{++} , Ca^{++} , Na^+ , H^+ must be balanced with the potential of blood (Fire-Minister in TCM and it is considered as a potential of OH^- ion). Normally, the total balance of active cells and the Intercellular liquid must be acidic, thus, the normal pH reading of blood, if we'll not take into account pH variations in arterial and venous vessels, is at range 7.3 - 7.4 units.

Of course, these figures can vary significantly depending on the presence of disease, climatic and dietary factors.

It should be understood that the concepts of acidity and alkalinity in this case is relative. It makes sense only for this group of chemical elements.

Disposition and properties of chemical elements for the active state of the cell is as follows:

K^+ , Potassium - Phase Fire in TCM, alkaline cytosol element. If there is alkaline intercellular liquid K^+ ion tries to get out of the cells, but injected back into cells by ionic pump. If the cell's environment is acid, K^+ ions diffuses from the cells freely;

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Mg⁺⁺, Magnesium - Phase Earth in TCM, acidic intracellular element. In the alkaline cytosol Mg⁺⁺ ion has low mobility, but at the acidic environment it diffuses out cells freely;

Ca⁺⁺, Calcium - Phase Metal in TCM, alkaline extracellular element and an element of special calcium depot within the cell. In an alkaline medium has a low mobility, but in an acidic medium it diffuses into the cell and then it is pumped from cytosol by calcium pump.

Na⁺, sodium - Phase Water in TCM, acidic extracellular element. In the alkaline extracellular media tends to diffuse through the membrane. In the acidic extracellular environment it is not mobile very much.

H⁺, hydrogen - Phase Wood in TCM, acidic extracellular element. In alkaline extracellular medium diffuses through the membrane inside cell. In acidic extracellular environment it has a low mobility.

Such distribution of acidity and alkalinity of above mentioned five ions may be confirmed by table of electrode potentials (table of ability of chemical elements to displace hydrogen from the water). The relative acid-base balance for this group of chemical elements is between Sodium and Calcium. The acid-base balance of blood of a healthy person is also shifted to the alkaline side.

In the active state of a normal cell the extracellular liquid has relatively acidic reaction. It is determined by the influence of acid concentration of hydrogen and sodium ions with the deduction of effect of alkaline concentration of Calcium ions. The relative capacity of an alkaline intracellular liquid is provided by a predominance of alkaline effect of Potassium ions with the deduction of the acid influence of Magnesium.

Now, knowing the role of each chemical element, the data of Pulse Metabolic Analysis (PMA) can provide us with important information regarding the functionality systems of the body which are associated with 12 acupuncture meridians of TCM.

Developers of PMA suggest, that the five above-mentioned chemical elements – H⁺, K⁺, Mg⁺⁺, Ca⁺⁺, Na⁺ plus the water (carrier of the Fire-Minister in TCM, hydroxyl ion OH⁻) define the metabolic environment for all the myriad of biochemical reactions in the body. Only certain proportions of elements hold the required electrostatic resting membrane potential (RMP) of cells. RMP creates proper condition for the large number of ionic pumps in living cells. Knowledge about the distribution of potentials among

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functional systems can help to understand the imbalances of the body as whole synchronized object. For example, the shift towards the acidic condition of blood accelerates the growth of collagen, reduces the permeability of membranes, but from the other hand the shift to the alkaline side promotes the dissolution of proteins and fats, increase degradation of morphological structures of cells.

Here we give an example of the dynamics of a patient with chronic renal failure.

First, here is the legend of diagrams of four indicators:

- Blue line - the acid-base balance (ABB) within the cell. Ideally, at the active state of the cell (state of Yang) blue line should be at small negative position (about minus 10 units). The more negative values reinforce the processes of degradation cell's structures. A positive value will inform about overcompensation of recovery processes after stress or inclination to uncontrolled cell division.

- Red Line - ABB outside of cells. Ideally, the red line should be at the level of plus 100 units. The more high position informs about risk of inflammatory reactions of the cell. Readings between 0 and 100 units indicate functional deficiency of cells, while negative values show pathological processes with destruction of the structures of the intercellular space.

- Purple Line – ABB of the blood. Ideally this line should be at minus 100 units. It indicates a normal alkaline shift of blood. More positive values of purple line correspond to the more acidic blood and indicate an attempt to detoxify the body, to destroy damaging agent located in the intercellular liquid. More alkaline reaction of the blood is indicated by a more negative level of purple line – in this case process of rejuvenation is fast so far as the cancer risk also increases.

- Green Line - the RMP of active cells. The ideal level of the green line is plus 100 units. Excessive levels mean the risk of inflammatory reactions of cells. Deficiency of green line indicates the dysfunction of cells. The negative potential shows the development of pathological processes.

Names of meridians are represented in abbreviation form in accordance with the Acupuncture Geneva Meeting at 1989.

Thus, look at the patient data before dialysis (Fig. 2):

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Acid - Base Balance

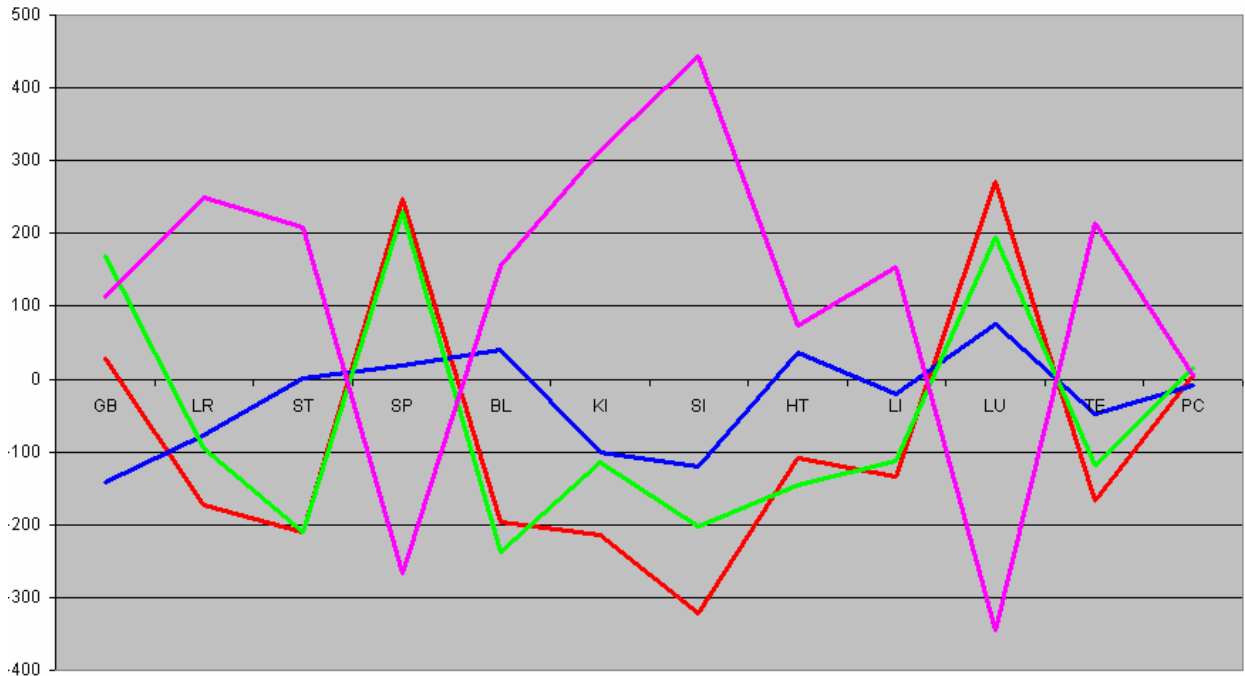


Fig. 2

Status of the blue line - the intracellular environment – there is a significant shift to the alkaline side in the systems GB (gall bladder), LR (liver), KI (kidneys), SI (small intestine), acidification of cells LU (lungs).

Status of the red line - the intercellular environment – there is pathological inversion of ABB to the base side at systems as follow: LR (liver), ST (stomach), BL (urinary bladder), KI (kidneys), SI (small intestine), HT (Heart), TE (triple energizer - blood cells).

Condition purple line - the blood - the average meaning has acidic character due to functional systems as follow: LR (liver), ST (stomach), BL (urinary bladder), KI (kidneys), SI (small intestine), HT (heart), TE (triple energizer - blood cells).

The RMP is positive only for systems GB (gall bladder), SP (spleen), LU (lungs). For other systems, the potential negative, and it means significant power of pathological processes.

Conclusion: there is destruction of cells and structures of the intercellular space in the following systems - LR (liver), ST (stomach), BL (bladder), KI (kidney), SI (small intestine), HT (heart), TE (triple energizer - blood cells). There is active process of cell's division in LU (lungs).

Consider the state of the same patient after dialysis:

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Acid - Base Balance

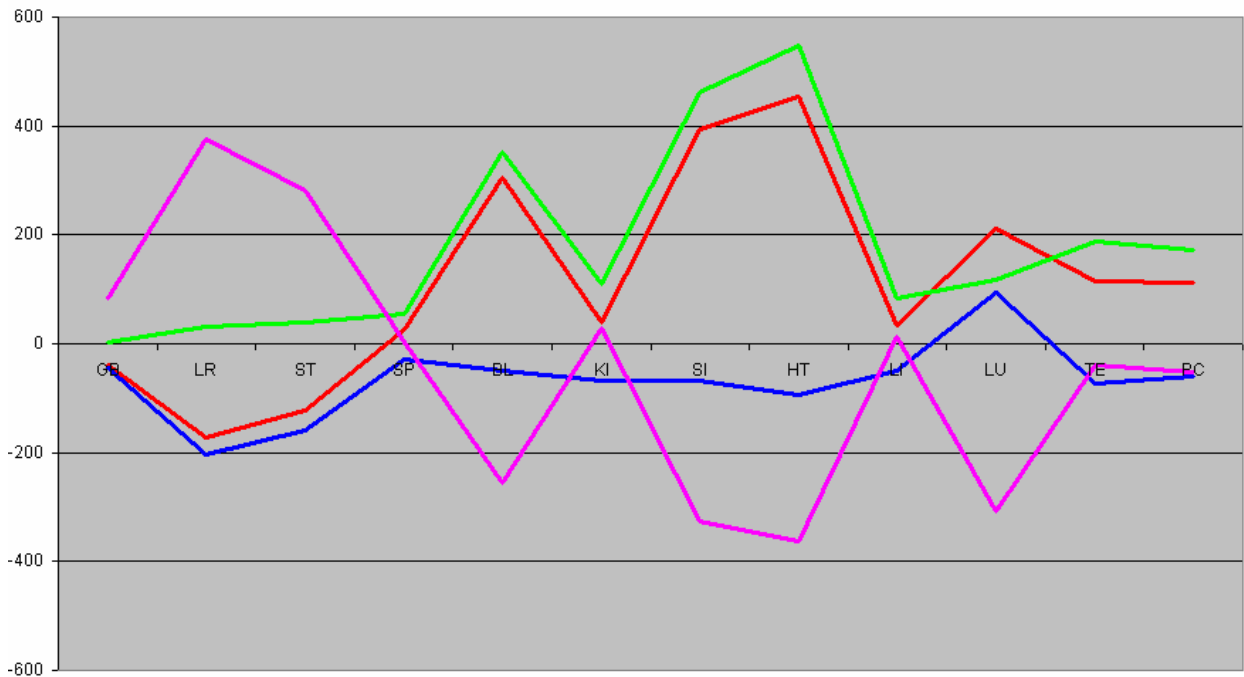


Fig. 3

Status of the blue line - the intracellular environment – there is significant shift to the alkaline side in systems LR (liver), ST (stomach), HT (heart), acidification of cells LU (lung).

Status of the red line - the intercellular environment - in comparison with the state before the dialysis condition is better, but it is characterized by large scored for BL (urinary bladder), SI (small intestine), HT (heart) – it may indicate the inflammatory reactions of cells. Status for systems LR (liver) and ST (stomach) has pathological inversion. But the situation is not bad completely as far as there is a positive difference between the red and blue lines – it is a sign of normal formation of the RMP.

Status of the purple line - blood – the condition is has a mixed picture, where there is the process of degradation in the systems LR (liver) and ST (stomach) on the background of a strong shift of the blood reaction to alkaline side at systems of BL (urinary bladder), SI (small intestine), HT (heart).

The RMP is positive for all body systems, but it is scattered very much. This configuration of RMP is a source of tension interaction between

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functional systems.

Conclusion: Despite the overall improvement, the state of LR (liver) has not changed, but even in absolute values, the state of cell's environment has become more alkaline. This alkalinity promotes more rapid cell death within that system. It also increases the process of destruction of cells belonging to the HT (Heart) and the risk of uncontrolled growth of tissue LU (lungs).

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