WHAT IS QI ENERGY FLOW? INTERPRETATION OF OUR RESULTS OF AMI MEASUREMENTS

by Naohiro Nagayama

ABSTRACT

From the AMI (the Apparatus for measuring the functioning of the Meridians and their corresponding Internal organs) data reported by us previously, it is discussed that Qi energy flow is flow of electric dipoles which are generated in cells.

Keywords: Qi(Qui, Ki) energy, electric dipole, intracellulare electric field, meridian, acupoint

Introduction

We have studied the changes of electrical properties in the skin with regard to many diseases or conditions, such as procedure of flexible fiberoptic bronchoscopy, tuberculosis, and acute hepatitis using the AMI (Apparatus for measuring the functioning of the Meridians and their corresponding Internal organs) invented by Motoyama.[1-4] And we found that in these diseases or conditions the changes of electrical properties occur at the Well points (the most distal acupuncture points of meridians lying in hands or toes) of the meridians corresponding to the organs related to these conditions or diseases. The interpretation and implication of our results of the measurements has not been discussed sufficiently. In the present manuscript the Well points of meridians and principles of AMI measurements are reviewed briefly at first. And then our results of AMI measurements and the interpretation and implication of them are discussed. And subsequently an answer for the problem of what the Qi (Qui, Ki) energy (a sort of subtle energy, which has been experienced in Eastern world from the ancient days) is, is pursued.

1 Well points

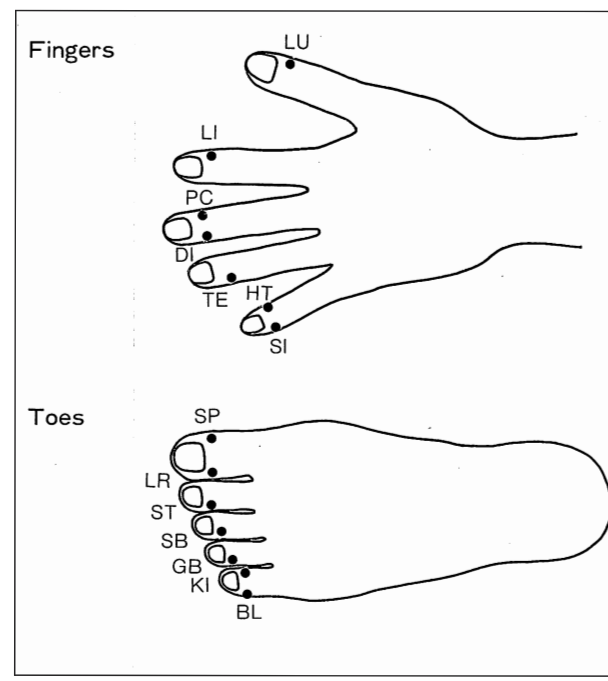
Near the roots of finger and toe nails (some 3 mm proximal to the base of the nail) are the Well points, where the meridians either begin or end depending on the direction of Qi flow. These Well points are traditionally known to sensitively reflect the condition of the meridians to which they belong. Figure 1 illustrates the Well points of the 14 meridians (12 are regular and 2 [Stomach Branch (SB) and Diaphragm (DI)] are extra meridians). The meridians are bilaterally symmetrical.

2 Principle of measurement

Square wave pulses (3 V × 256 μsec) are sequentially applied between each active electrode put on the Well point, and the indifferent electrode put on the extensor surface of each forearm about 5 cm above both wrists, through an external electric resistance of 100 Ω.[4]

A response electric current which flows in the circuit is shown schematically in Figure 2. The peak current that flows immediately after the application of the external electric potential to the skin is called the before polarization (BP) current. This current is thought to penetrate through all the cells and intercellular spaces with electrical capacity, including those layers possessing dielectric membranes such as the epidermis and dermis. The BP current is followed by an exponentially decreasing current, which reflects the polarization process in the tissue. The steady-state current that flows after completion of all polarization is called the after polarization (AP) current. The steady state is normally reached within approximately 200 μsec. The total electric charge that is mobilized during the polarization process is called integrated qoulomb (IQ), or total electric charge.

Figure 1. Well points of 14 meridians
Upper extremities: LU; Lung, LI; Large Intestine, PC; Pericardium, DI; Diaphragm, TE; Triple Energyzer, HT; Heart, SI : Small Intestine
Lower extremities: SP; Spleen, LR; Liver, ST; Stomach, SB; Stomach Branch, GB; Gall Bladder, KI; Kidney, BL; Bladder. Nomenclature of meridians is referred to WHO STANDARD ACUPUNCTURE POINT LOCATIONS IN THE WESTERN PACIFIC REGION (2008).



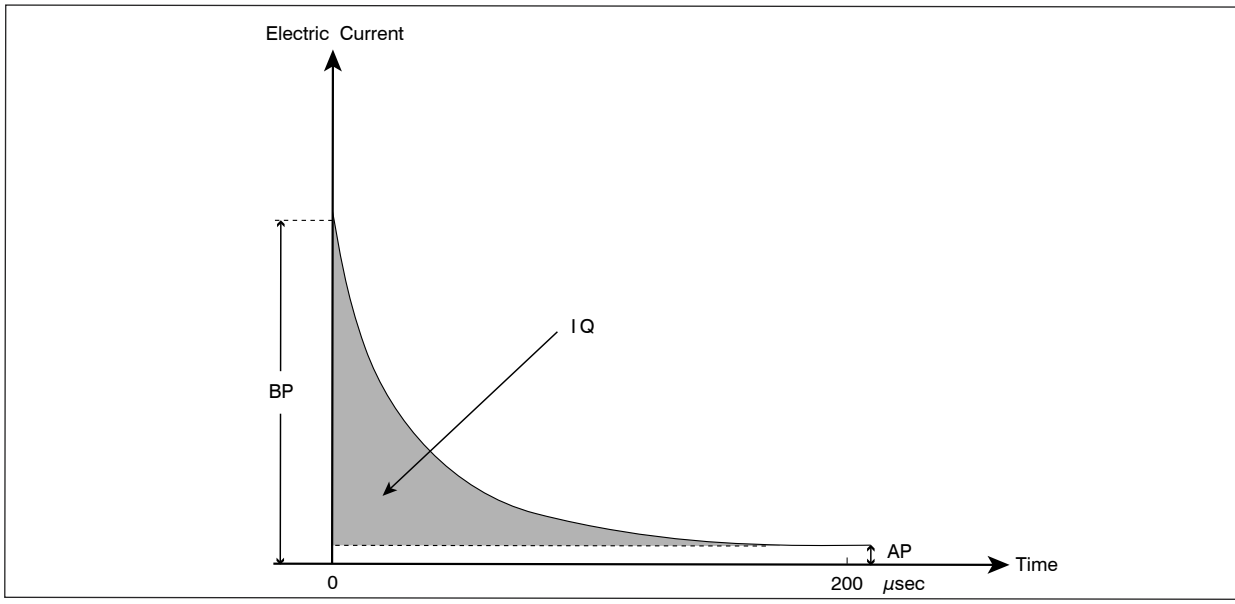


Figure 2. A schematic diagram showing definition of parameters BP, AP, and IQ.
BP: Before Polarization (current), AP: After Polarization (current), IQ: Integrated Qoulomb (total electric charge).

BP current depends on the distance between the different and indifferent electrodes, but IQ does not, indicating that IQ is determined solely by the skin properties just beneath the different electrodes.[1]

Inserting needle electrode into the skin by increments of 3 to 5 microns, Motoyama et al measured sequentially the BP and AP currents.[3,5] They found that BP and AP currents became zero or near zero around basal cell layer, at some level of sub-papillary layer, and at the level of boundary between sub-papillary and reticular layers (Figure 3), indicating that some sort of insulators lie at these levels. Their experiment was done by applying square-wave voltage (0.5V×256μsec) between the different and indifferent electrodes pair put on a sole of the foot. Condensers of large amount of capacities are thought to exist at the above-mentioned levels. As layers or boundaries which are anatomically identified clearly do not exist in sub-papillary or reticular layers, the needle electrode might be in the collagen bundle or in another fibers when electric current became zero in their experiment.

The electric capacitance of condenser C is calculated as:

$$C=\varepsilon \cdot S/d$$

Where S is a surface area of condenser, d a distance between the two confronting condenser plates, and ε the permittivity of dielectric substance filled between the two condenser plates. In the skin S and d are not easy to be altered, especially in the acute or sub-acute diseases (or conditions), while the permittivity of cells or tissues are easily altered by the change of ionic composition and ionic amount in cells or tissues. For example, the increase of the amount of ions in the basal cells and in collagen, elastic, or reticulum fifers in the dermis, will increase the permittivities of the basal cell layers and of collagen, elastic, or reticulum fibers in the skin, respectively, and as a result IQ is increased. In this way it is supposed that IQ reflects the electrical capacity, and therefore ionic conditions, of basal membranes and other dielectric tissues of the epidermis just beneath the plate electrodes at the Well points.

BP current mainly flows in the dermis parallel to the skin surface. Electrical conductivity is thought to be influenced by ionic contents and concentration in the

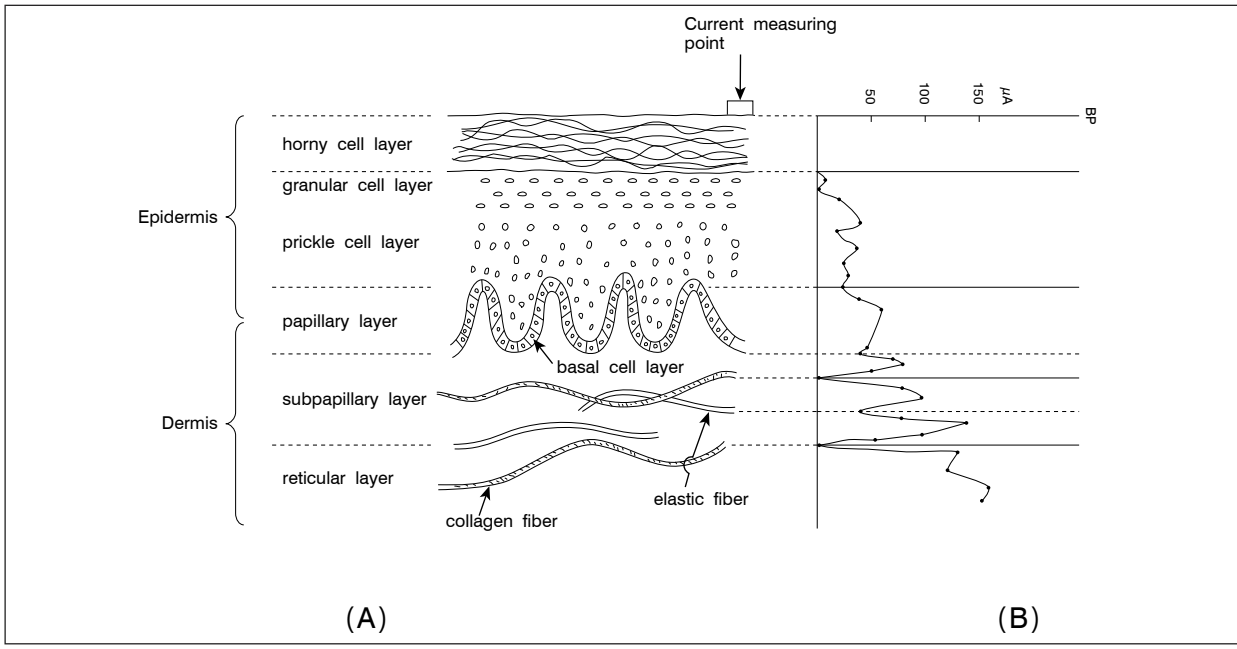


Figure 3. A schematic diagram of skin (A) and BP current measured at contiguous depth levels in the skin (B). BP current in Figure (B) is measured at the current measuring point in Figure (A). Rearranged from Ref(5). Notice that at some levels of skin BP current decreases to or near zero, indicating the existence of dielectric materials.

dermis and in the subcutaneous tissue as is the case with solution. Therefore, when BP value is increased, the ionic concentration in the dermis and in the subcutaneous tissue between different and indifferent electrodes, especially along meridians corresponding the Well points, is increased. In other words, the more abundant the amount of charged substances such as electrolytes and ions in dermis and subcutaneous tissue is, the more easily the electric current can flow in dermis and subcutaneous tissue when electric voltage is applied in the circuit.

3 Main results of experiments previously done by us and the interpretation and implication of them

a. Stimulation to an organ and response of the corresponding meridian

When procedures such as bronchial brushing, washing, curetting, or trans-bronchial lung biopsies (TBLB) using flexible fiberoptic bronchoscopy are done to a lung, the IQ values at Lung (LU) Well points (on the thumbs) alone decrease, while the BP and AP values at Lung Well points do not change at all as those at other Well points (Figure 4).[1] Likewise, when broncho-alveolar lavage (BAL) procedure (which is more hard and stressful than bronchial brushing, washing, curetting, or TBLB procedures for participants (patients) receiving the procedure) is done to a lung, the IQ values at Lung Well points also decrease as in cases of bronchial brushing, washing, curetting, or TBLB procedures. However, the decrements of IQ value at Lung Well points in BAL procedure are larger than those in bronchial brushing, washing, curetting, or TBLB procedures (Figure 4). Moreover, the IQ values at other Well points belonging to upper extremities such as Large Intestine (LI), Pericardium (PC) and so on, also decrease, and the BP values at LU Well points alone decrease while BP values at other Well points do not change at all.

These results are interpreted as follows. After bronchial brushing, washing, curetting, or TBLB procedures (which are light stimuli to a lung) the amounts of ionized substances just beneath the LU

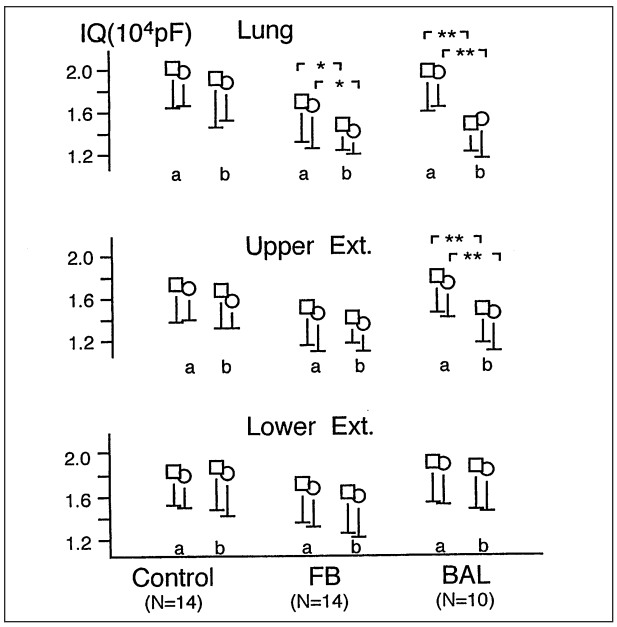


Figure 4. The IQ values of Lung, averaged upper and lower extremities' meridians in the control, FB and BAL groups. Open squares(□) and circles(○) show mean values measured using the indifferent electrodes put on the extensor surface of forearms and lower legs, respectively. Error bars show − 1 SD. The alphabet a and b in each group shows 1st and 2nd (before(a) and after(b) flexible fiberoptic bronchoscopy for FB and BAL groups) AMI measurement. No. in the parentheses show no. of cases. Lung ; Lung meridian, Upper Ext.; averaged upper extremities' meridians, Lower Ext.; averaged lower extremities' meridians. Notice that in BF group IQ at LU well point alone decreased, while that in BAL group not only IQ at LU but also IQs at other well points in the upper extremities decreased.
** p< 0.01*
*** p< 0.001*

Well points decreases. While after BAL procedure (heavy stimuli to a lung) the amount of ionized substances just beneath all Well points belonging to upper extremities decreases, probably indicating that the amount of ionized substances beneath all the tips of fingers decreases. Moreover, the amount of ionized substances along LU meridians also decreases in BAL procedure. After bronchoscopic procedures lung cells such as alveolar epithelium, endothelium, cells in the bronchial walls and so on, are damaged temporally, and metabolism in these cells may be decreased. These phenomena in the lungs are supposed to be reflected via meridian tracts to the LU Well points and other Well points in the upper extremities depending on the severity of procedure. This is an example of relationship between stimulation to an organ and response of the corresponding meridian tract.

b. Disease of an organ and response of the corresponding meridian

In sub-acute phase of drug-induced hepatitis due to anti-tuberculosis drugs the IQ values of Liver (LR) meridians decrease (Figure 5).[2,3] Likewise, in acute severe viral hepatitis the IQ values of LR meridians decrease in the acutely ill period. And the IQ values of LR meridians increase in the recovery phase of the disease3 (Figure 6). As discussed above, the increase and the decrease of IQ values reflect the increase and the decrease of the amount of ions in cells and tissues just beneath the Well point, respectively. When the liver is damaged by hepatitis viruses or drugs, liver metabolism is disturbed and diminished, while when the liver is in recovery phase from the disease or damage, liver metabolism is prompted and increased. That is to say, the degree of metabolism in the liver is reflected to the IQ value at the Well point of LR meridian (the higher the former, the higher the latter). In the case illustrated in Figure 6, the exfoliation of the extremities occurred simultaneously with the increase of Liver IQ values, indicating that the total electrical change in the skin parallels with the promotion of the metabolism of the skin. Namely, high metabolic rate of the liver is reflected to high metabolic rate of the skin in the extremities. In this way it became evident that degree of metabolism in an organ was reflected to the ionic state of skin just beneath the corresponding Well points, and in some cases to the ionic state of skin along meridians, of the organ. In other words metabolism in cells of an organ is connected with the ionic condition at the tip of extremities and along meridians.

What mechanism(s) stands between the two phenomena seen at two organs (for example, liver and skin) far distant from each other?

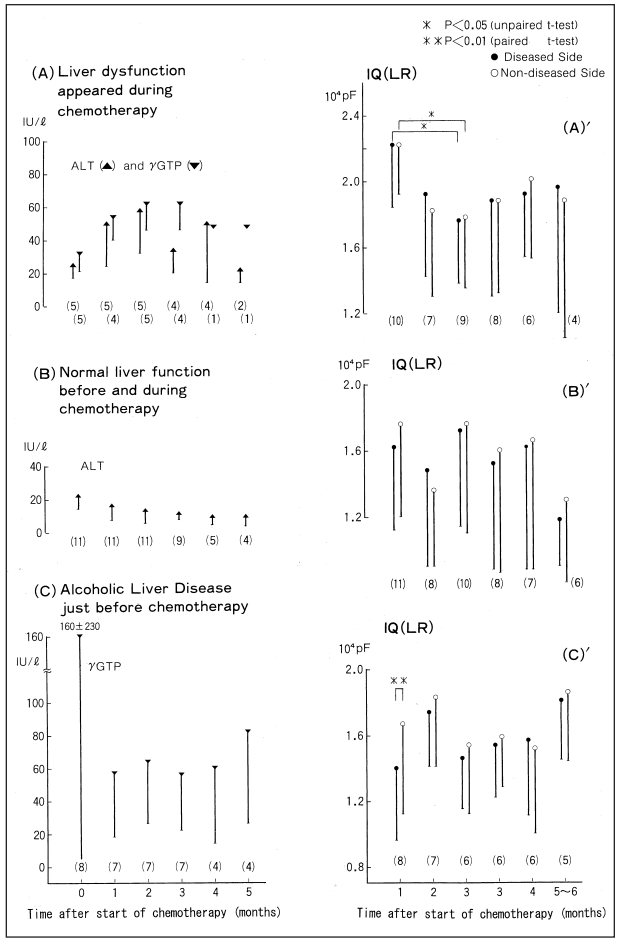


Figure 5. Relationships between liver function and IQ value of liver(LR) meridian in the cases of anti-tuberculosis drugs-induced hepatitis. Changes in time of serum ALT (alanine transferase) and/or γ-GTP (γ-glutamic acid transferase) values of three groups classified by liver function are illustrated by mean (▲ and/or ▼) -1SD (bars) on the left side of the figure ((A),(B), and(C)).
The corresponding changes of Liver(LR) IQ values in each group are also illustrated by the mean(solid and open circles) -1SD(bars) values on the right side of the figure ((A') (B') and (C')).
The solid circles denote mean liver(LR) IQ values of the diseased or more severely diseased side of the patients and the open circles those of the non-diseased or less severely diseased side of the patients. Notice that in the case of liver dysfunction due to anti-tuberculosis drugs IQ at LR well points decreased (upper figures).
Numbers in the parentheses show number of cases.
** p<0.05 (unpaired Student's t-test)*
*** p<0.01 (paired Student's t-test)*

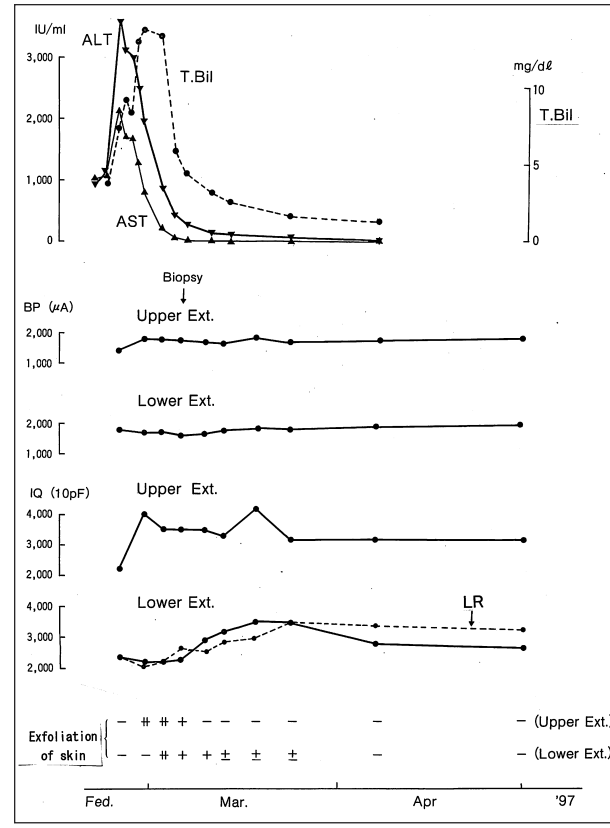


Figure 6. Clinical course of a 52-year male patient with acute viral hepatitis type A.
ALT, AST (aspartate transferase), and T. Bil (total bilirubin) increased in the acute phase, and decreased in the recovery phase. IQ at Well points in the lower extremities (including LR) decreased in the acute phase and increased in the recovery phase. In the recovery phase exfoliation of the skin also occurred.

Recently, intra-cytoplasmic electric field has come to be measured using intracellular nano-voltmeters.[6] And theoretical calculation of an intra-cytoplasmic electric field also has come to be attempted. For example, Gatenby and Frieden calculated the intra-cytoplasmic electric field generated between the positively charged nuclear membrane and the negatively charged phosphorylated molecules participated in the EGFR(epidermal growth factor receptor) pathway, which originate from cell membrane.[7] They showed that the electric field accelerates isolated messenger proteins with negative charges added by phosphorylation toward the nucleus

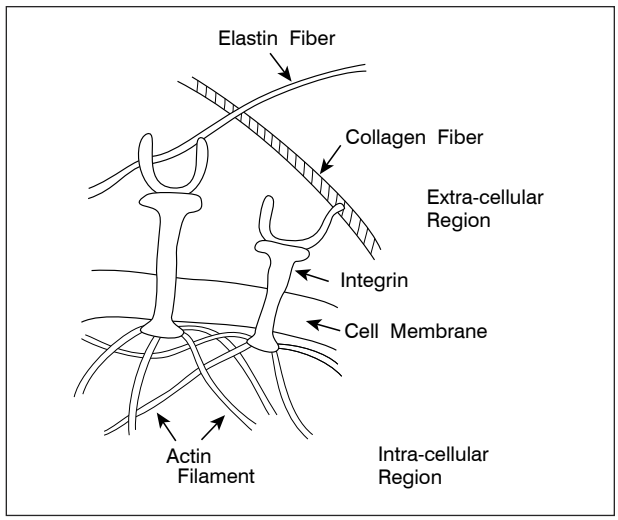


Figure 7. A schematic diagram of relationship between cytoskeleton and extra-cellular matrix.

through Coulomb interactions. This suggests that the intra-cytoplasmic electric field is closely connected with metabolism in cytoplasm. It is supposed that the higher the metabolic rate in a cell, the larger the electric field generated in that cell.

As already stressed, it is assumed from our results of the AMI measurements that degree of the rate of metabolism in a tissue is reflected to degree of ionic concentration in the skin just beneath the corresponding Well points and along the corresponding meridians. On the other hand, higher rate of metabolism in a cell will be related to the appearance of stronger electric field (or more abundant ions) in the cell. From these situations we may deduce there may be some mechanism(s) that transfer the electric field (or ions) in the cytoplasm even to the most distal point in the extremities, and that its (or their) mechanism(s) must be simple because these phenomena will be widely seen in most organs in the body.

The cytoplasm of all eukaryotic cells is crisscrossed by a network of protein fibers that supports the shape of the cell and anchors organelles to fixed locations. This network, called the cytoskeleton, is a dynamic system, constantly forming and disessembling. The cytoskeleton is made up of three different types of cytoskeletal fibers including actin filaments (sometimes called microfilaments), microtubules, and intermediate filaments.[8] Along these filaments, especially actin filaments and microtubules, electric charge is assumed to be transmitted.[9,10] The cytoskeleton is connected extra-cellular matrix (ECM) such as collagen and elastic fibers, via integrin in the cell surface (Figure 7).[8]

There may be some mechanisms that transmit ions or electric field in cytoplasm through cell membrane to ECM outside the cell. It has been ascertained that integrin plays an important role as ion channels.[11] Therefore, due to cytoplasmic electric field anions and cations in the cytoplasm may be transmitted to ECM via integrin and flow to Well points of extremities along meridians. In other words positive and negative ion pairs (i.e. electric dipoles) propagate from organs to corresponding Well points through meridians.

Another possibility is that electric voltage difference produced in the cytoplasm is assumed to be a battery, and that cytoskeleton, integrin, and ECM are assumed to be a lead wire where electric current flows. Any organ is not isotropic at all, instead many organs may have a kind of electric polarity. Cells in some organs are known to have cellular polarities. For example, hepatic cells (hepatocytes) are arranged in plates one or two cells in thickness, with blood-filled sinusoids on each side of the plates (this architecture is called hepatic cell plate), and lie between portal tract and central vein (Figure 8(A)). Hepatic cells have a clearly contoured cell membrane which is divided largely into 2 compartments defined by morphological and functional cellular polarization; namely, one is sinusoidal surface which have numerous microvilli and face to sinusoid space, and the other is intercellular surface where hepatocytes joint with each other. The latter is further divided into canalicular surface and intercellular fissure.[12] The hepatic cell plates, facing to sinusoidal space, run radially from the portal tract to the central vein. This situation is said to have cellular polarity.[13] Alveolar cells and gastrointestinal epithelial cells

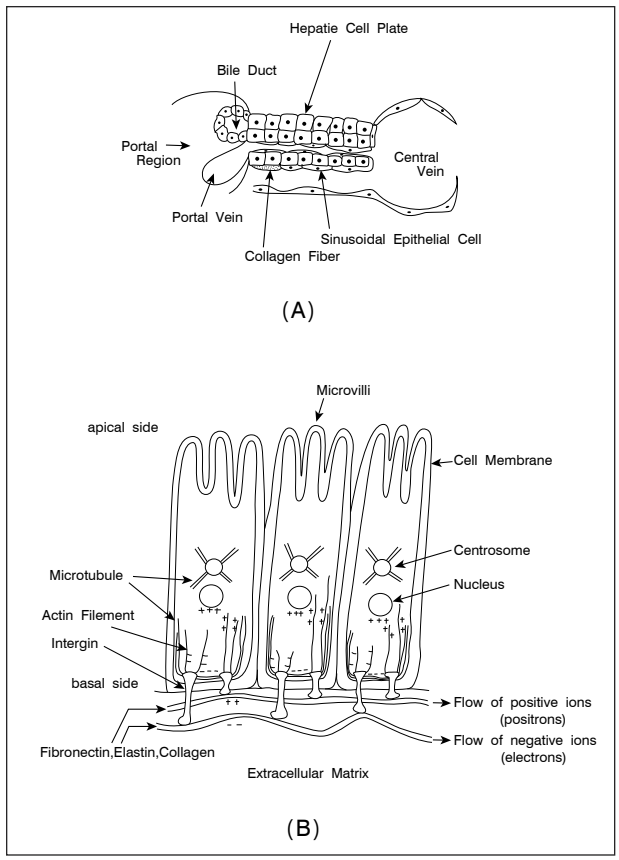


Figure 8. Cellular polarity in hepatic cells (A) and epidermal cells (B). A hypothetical model of electric current generation in the interstitium is also shown in Figure (B).

show simpler cellular polarity (Figure 8(B)). Cellular polarity is important not only morphologically but also functionally.

Electric field emerged in cytoplasm will have the same direction in almost all cells in organs, such as liver, lung and gastrointestinal tracts, because of cellular polarity. Therefore, mean electric field emerged in cytoplasms will have a finite value other than zero (electric polarity of tissue) because of cellular polarity, and therefore, if the electric field is partially transmitted from inside the cytoplasm to ECM it will create the electric current which may flow through the meridian (Figure 8(B)). In other words counter currents will flow in the same meridian. This situation may be interpreted, for the sake of convenience, as flow of electric dipoles composed of electrons and positrons.

In summary, positive and negative ion pairs outside cells may propagate along collagen and elastic fibers to the tips of extremities. It is said that meridians are anatomically associated with connective tissue planes.[14,15] Qi energy is thought to flow along meridians. In this scheme Qi energy is thought to be a flow of electric dipoles which originate from cells.

Modern physics teaches us that there are four forces in the universe: gravity, electromagnetic force, and strong and weak interactions. Some 95 % of energy of the living systems is thought to come from electromagnetic force. Actually, structure of cells and tissues, and signals generated in the living system come from electric force in almost all situations in the living systems. Therefore most textbooks of biology at first give a description of molecules, ionic bonds, water's structure, acids and bases, carbohydrates, nucleic acids, and so on. First living cells on the Earth maintained the ionic state in itself to be different from that outside the cells (i.e. the sea). Communication between cells is common in the living system. Effective signaling requires a signaling molecule, called a ligand, and a molecule to which the signal binds, called a receptor protein. The interaction of these two components initiates the process of signal transduction, which converts the information in the signal into a cellular response. Cells can communicate through any of four basic mechanisms: direct contact, paracrine signaling, endocrine signaling, and synaptic signaling.[8] All these mechanisms come from electric force. Meridian reaction may be fifth mechanism of communication between cells far apart from each other.

c. Balancing mechanism of body via meridian reaction

In cases with unilateral tuberculosis the IQ value of LU meridian in non-diseased side decreased to ordinary level 2 months after start of anti-tuberculosis chemotherapy, indicating that Qi flow of LU meridian in non-diseased side is increased before start of chemotherapy.[2] This is interpreted as an activation of metabolism in non-diseased lung

Figure 9. Qi flow in the nature.

more than the ordinary level to compensate the decrease of metabolism in diseased lung.

In a case with acute severe viral hepatitis the IQ values of meridians belonging to upper extremities increased at the peak of acute liver injury, while the IQ values of meridians belonging to lower extremities, such as LR, Stomach (ST), and Gall Bladder (GB), increased later, in the recovery phase (Figure 6).[3] This indicates that the organs whose meridians run through upper extremities, such as lung, heart, and large intestine, help the recovery of injured liver via meridian reaction in some mechanism.

In cases with acute severe asthmatic attack the IQ value of right LR meridian decreases.[16] This indicates that broncho-constriction causes the decrease of metabolism in liver, perhaps to concentrate energy on respiratory muscles. In this way the body responds to the diseases or the injury added from outside to balance as a whole body using meridian systems, as neurological, hormonal, and immunological systems.

Flow of electric dipoles in the body may be able to interact with environment which also may have various flows of electric dipoles. Qi energy flow has a possibility of flowing through bodies in the nature, indicating that a person can not be isolated from, but is always connected to the environment. One of the reasons why we feel comfortable in the woods or on the mountain may be this circulation of Qi flow through our body in the nature (Figure 9).

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