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Can the Primo Vascular System (Bong Han Duct System) be a Basic Concept for Qi Production?

Review Article

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Abstract **Background:** A new system of circulation has been found in some small animals recently and it was suggested that this new system could exist in the human body too. The system could potentially explain all the abilities and mechanisms of traditional medicine along with Chinese traditional medicine. In the early 1960s, the time of its discovery, it was called Bong Han Duct (BHD) which afterwards, during an international meeting in Korea in 2009, was changed to Primo Vascular (or Vessel) System (PVS). **Methods**: This is a library study. Previous studies on the BHD are the basis of this report, but by considering some other views, such as biophoton, it attempts to discuss scientifically some traditional Chinese medicine (TCM) frameworks, such as Qi, Meridian and AP. **Results:** This system is similar to a network composed of a duct containing some sub-ductuls and corpuscles which are like a control canon and act as a control room for these ducts. In these ducts, very small floating granules are present and these contain genomic information. The information of one or two chromosomes is in each granule. These granules stay afloat in a fluid termed primo fluid and contain amino acid, hyaluronic acid, more than 270 proteins and some other substances vital for cells and tissues. **Conclusion:** It is the first report to describe the issue of Qi, Meridian and acupuncture points. In this brief review article, the system of BHG has been studied and introduced as a possible fundamental part and justification of the mechanism(s) involved in the abilities of traditional and biomedicine and also Qi formation. Additionally, PVS is considered as a possible circulatory organ explaining the anatomical arrangement of the acupuncture meridian system.

Keywords Acupuncture, Bong Han Duct, Circulatory system, Corpuscles, Ducts, Granule, Primo Vascular System, Traditional Medicine, Qi

1. Introduction

A good starting point is to work out some of the characteristics of acupuncture points (AP). In order to understand Electrical Skin Resistance (ESR), we firstly study some typical features of acupuncture points (AP). It has been clear for a long period of time that some parts of the skin have a different ESR from the surrounding

region. The first reports indicating this phenomenon date back to the 1950s [1, 2]. There was no proof of a physiological foundation for the stated theory [3, 4]. There are different known agents [5, 6] affecting ESR measurement outcomes. The electrode tip continuously presses into the skin, scratches over the skin's surface depending on the change of pressure, duration of the measurement or angle, may cause hyperaemia and superficial scratches of the stratum corneum layer which can considerably affect the outcomes and rise in electrical conductivity. One piece of research has reported the results of ESR measurements in the 34th point of the Gall Bladder (GB) meridian, or GB34. Contrary to the general postulation that the ESR at acupuncture points is lower than the ESR of the surrounding regions, the ESR measurements of the GB34 point presented no considerably diversity at all. Even some measurements exhibited significantly higher ESR at GB34. [7]

What is the physiology of acupuncture point (AP) functions? Is this physiologic function in the superficial layer or a deeper layer? The Chinese style of acupuncture applies deep and the Japanese style superficial needling and, accordingly, the therapeutic results are equal for both of them. Thus, the conclusion can be drawn that, for acupuncture action, at least superficial needling is necessary. There are some other unaccountable findings that will complicate the issue. In one piece of research, deactivations obtained by acupuncture were much more remarkable than the activations [8, 9]. The dominance of the deactivations has been strongly connected to acupuncture's supposed therapeutic role in a speculative manner [8].

What will happen after the needling effect phenomena? After acupuncture, in some pieces of research into endorphin releasing, it has been shown that acupuncture's physiological impressions can last for many hours [10] and clinical positive effects can be maintained over a long periods of time [11]. Even after the discontinuation of AP, the persistency of acupuncture's effects can be proven [12].

Based on these features, there must be some physiological activities which occur at acupuncture points which are unlike their adjacent areas and certain manipulations conducted on them are accompanied by changes in the body's physiology which may be due to endorphin release. This subject needs more attention in order to explain the functioning of AP.

2. Methods and Materials

The existing literature was reviewed to address these key themes: Bong Han Duct, BHD, Primo Vascular System, PVS and Traditional Medicine.

Search strategy: The following databases were searched for English language, peer-reviewed articles: Cochrane Collaboration, PubMed, MEDLINE, CINAHL, AMED, Ageline, and Social Services Abstracts. The search strategy included the following keywords, singly or in combination: complementary medicine(s), alternative medicine(s), integrated medicine and holistic care, Bong Han Duct, BHD, Primo Vascular System and PVS. Every report about these Items was collected and reviewed to determine a concept for this system.

This is a library study. Previous studies on the BHD are the basis for this report, but by considering some other views, such as biophoton, it attempts to discuss scientifically some Traditional Chinese Medicine (TCM) frameworks, such as Qi, Meridian, AP and so on. This is the first report of a series of reports which will look into these issues. The first report includes an examination of AP and Qi. The views of this review were presented partially at the 7th International Congress of Medical-Cosmetic Acupuncture and at *312 meridian exercises*, 2012, Nov, Aurangabad, India [13] and here the full report is presented.

3. Results

A Korean scholar called Bong-Han Kim claimed, in the early 1960's, to have discovered a novel circulatory system which is a body-wide web of vascular threadlike structures in an animal and in which float a new fluid. This system is more primordial than the vascular and the lymphatic systems in the developmental sense and possibly in the evolutionary sense as well. The primo-fluid keeps an animal healthy by regenerating damaged tissues and healing wounds. This wide web of vascular structures was called BHD and this network is formed with a widely interconnected system of corpuscles and ducts. "Figures 1 and 2"

Bong-Han Kim did not, however, disclose his methods of observing the system and no one could confirm his claims despite intensive attempts in China, Japan, and Russia.

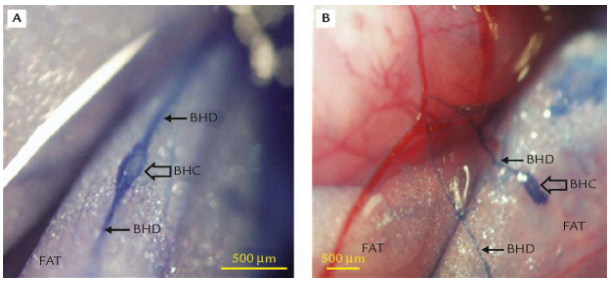

Figure 1. Trypan blue staining of BHD (PV) and BHC (PN) inside adipose tissues. (A) BHC (PN) and connected BHD (PV) inside adipose tissue around a rat's small intestine. (B) BHC (PN) and two BHDs (PVs) near the same rat's small intestine; the blood vessels and adipose tissues are not stained. "Reprinted with the permission of Professor Kwang-Sup Soh"[18]

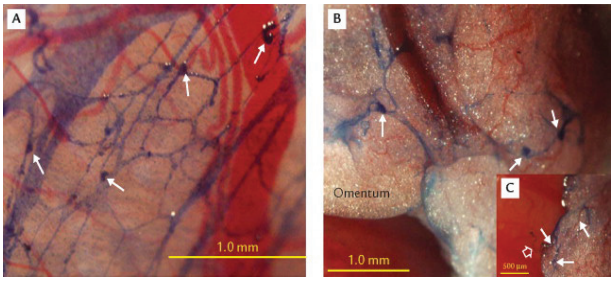

Figure 2. A web-like network of BHDs revealed by using trypan blue. (A) A web of BHDs (PVs) on the visceral peritoneum around the stomach near a rat's spleen; several small BHCs (PNs) at crossing points (arrows); blood capillaries are not stained. (B) A network of BHDs (PVs) on the omentum below the stomach and above the small intestine; three small corpuscles (nodes) at crossing points of BHDs (PVs) (arrows). (C) Inset: another part of the same omentum as (A); a floating BHD (PV) (open arrow) connected to several BHDs (PNs)(arrows) in the omentum, showing several BHDs (PVs) on the omentum as part of a larger network of freely movable BHDs (PVs) on internal organ surfaces. "Reprinted with the permission of Professor Kwang-Sup Soh" [19]

Since the original discovery could not be replicated by other international researchers, it was therefore neglected as a pseudoscience for about 37 years [14].

After studying different types of dye stains, Kwang-Sup Soh et al. discovered that Trypan Blue is an effective dye for staining the structure of BHD. Some methods for applying modern technologies to rediscover most of the BHD have been developed at Seoul National University since 2002. The name, Primo Vascular System (PVS) has been used instead since 2009 and during a congress on BHD. [15] Bonghan Kim's statement was unique and it suggested the presence of a new circulatory system spread through the body of not only humans, but all of the vertebrae [16]. He demonstrated that corpuscles or a Primo Nodes (PN) and ducts or Primo Vessels (PV) match with APs and Acupuncture Meridians (AM) respectively [16].

A recent piece of research has shown that after two weeks of inoculating of human lung cancer cells in a mouse model subcutaneously, grown cancerous cells were found to be present, and then, after a resection of the skin, the PVS were visible barely, but the PVS structure was fully revealed after a Trypan blue staining. [17]

On the sub networks of PV and PN: "This network and circulatory system is composed of several sub-networks located at various sites inside the body. These sub-networks can be categorized as: (1) Superficial (located in the skin), (2) Intravascular (along the interior of the large veins, arteries, and lymphatic vessels) which are afloat and not adhering to the vessel wall, (3) Extra-vascular (along the exterior of large blood vessels), (4) Organ-surface (on various internal organ surfaces), (5) Intra-organ (inside various internal organs), and (6) Neural (inside the brain and spinal cord) and runs along the exterior of the peripheral nerves." [16] Figures 1, 2, 3 show the PVS around a rat's small intestine, a rat's stomach/spleen and in a rabbit's brain, respectively. [18-20]

The creatures including human body are surrounded by a network of this wide web-threadlike structure, which connects all the cells and points of the body to each other to create a whole being or in other words, a whole point or "coherent body".

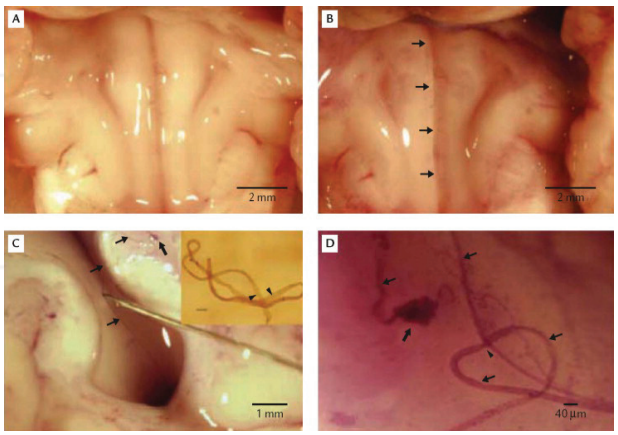

Figure 3. BHD (PVS) in the brain ventricles of rabbits. Stereomicroscopic images at the bottom of the fourth ventricle beneath the cerebellum of same rabbit before, (A), and after, (B), haematoxylin application. No BHD (PV) visible in panel A but, after haematoxylin staining and washing, BHD (PV) (arrows) emerged near the sulcus, panel B. (C) Stereomicroscopic image of a BHD (PV) (arrow) in an aqueduct and third ventricle of a rabbit's brain after haematoxylin and washing, lifted using a needle to show it was a floating tissue in a cerebrospinal fluid. Inset: wounded state of a specimen of a threadlike structure, showing its elastic nature; overlapped regions show its optical transparency; two nodes present (arrowheads); scale bar, 60 µm. (D) Stereomicroscopic image of a BHD (PV) (arrow) with a corpuscle (node) (thick arrow) and a node (arrowhead); one end of a BHD (PV) cut at front part of the third ventricle. "Reprinted with the permission of Professor Kwang-Sup Soh" [20]

4. Discussion

Trypan blue stains PV and PN rather than blood vessels, nerves, adipose tissues, muscles, or lymph vessels in a preferential manner. Trypan blue is useful for the vivistaining of vitreoretinal membranes in ophthalmic surgery [21]. It stains PVS but not other kinds of tissues in a strange manner; as such, it was a highly helpful dye in discovering PVS in different settings [16].

The PVS is difficult to notice due to the fact that it is a threadlike, thin (~20µm in diameter), transparent structure which floats inside a dense blood stream, therefore requiring particular staining practices such as an Alcain blue injection, for its visualization [22]. Because of its small size and clearness, the intra-vascular Bong

Han duct cannot be detected either by light microscopes or magnifying glasses. Only under phase contrast microscope is the duct detectable, and then only barely, but almost imperceptible from fibrins (figure 4) [23].

The PV is a flexible tissue and, once broken, it can curl and shrink. During any surgery, the PV would be broken and could develop quickly to re-establish the network. If the PV is not re-established for some reason, the recovery from surgery could be hampered or some side effects may continue [24].

4.1 Is there any structural difference between PVS and Blood or Lymphatic vessels?

The shapes, lengths, and distributions of rod-shaped nuclei are similar to each other in all four cases in figure 5, suggesting that BHDs in lymph vessels, in blood vessels and on organ surfaces belong to the same system and differ from lymphatic and blood vessels (Figure 5) [25-28]."

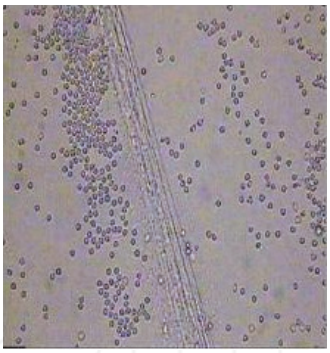

Figure 4. Differential interference contrast image of a Bong-Han Duct "Reprinted with the permission of Professor Kwang-Sup Soh"[23]

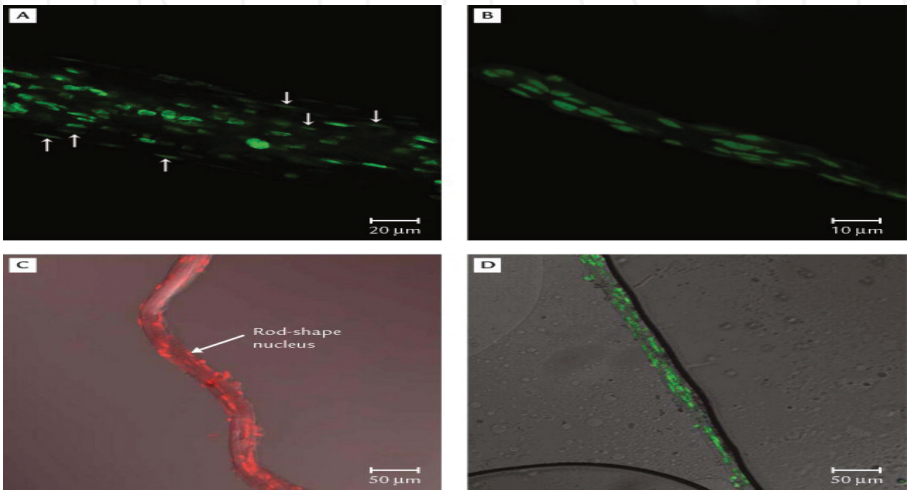

Figure 5. (A) A BHD stained by YoYo-1, a DNA-specific dye, after removal from Alcian-blue-injected rabbit's lymphatic vessel (B). BHD stained by Acridine orange, a DNA-specific dye, after removal from a Janus-Green-B-injected rabbit lymphatic vessel (C). The BHD was stained using a Feulgen reaction, a DNA-specific dye, after removal from the rabbit's organ surfaces (D). BHD was stained by Acridine orange after removal from the rabbit's caudal vena cava "Reprinted with the permission of Professor Kwang-Sup Soh" [28].

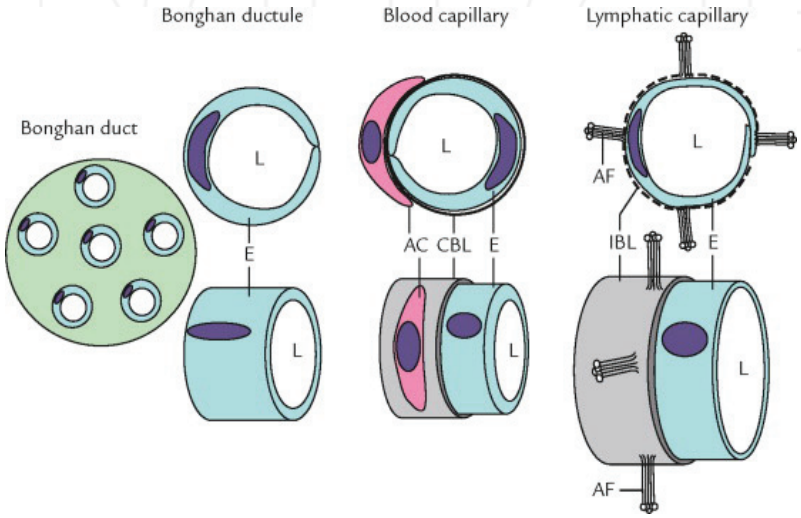

Figure 6. Structural properties of a Bonghan ductule and of a blood and lymphatic capillary. E = endothelium; L = lumen; AC = accessory cell; CBL = complete basal lamina; IBL = incomplete basal lamina. AF=anchoring filaments "Reprinted with the permission of Professor Kwang-Sup Soh"

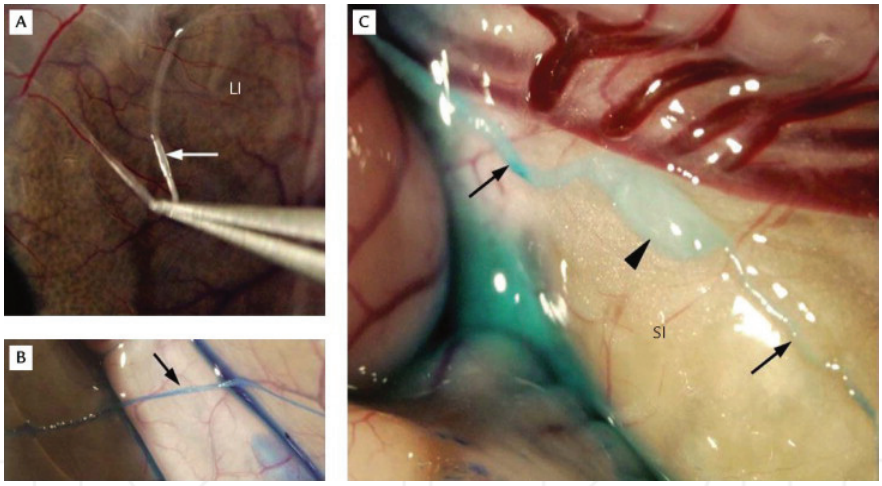

Figure 7. Stereomicroscopic images of Bonghan ducts (PV) and corpuscles on the surface of a rabbit's internal organs. (A) A Bonghan duct (PV) (arrow) on the large intestine surface (LI); an intact duct, a semitransparent, freely movable tissue structure. (B) A Bonghan duct (PV) (arrow) after methylene blue staining. (C) A Bonghan corpuscle (PN) (arrowhead) on the small intestine (SI) linked with Bonghan ducts (PV) (arrows); corpuscle and ducts contrasted using methylene blue. "Reprinted with the permission of Professor Kwang-Sup Soh" [29]

The histological structure of BHDs appears simple. The BHD are organized from a bundle of several ductules, showing characteristic rod-shaped nuclei (10-20μm in length) that were obviously detectable with phase-contrast microscopy [29]. In cross-section, the BHD appears as a small tissue formation, containing some small lumens, 6-10μm in diameter. The lumen of the ductule included a single layer of endothelial cells enclosed by an extracellular matrix (Figure 6) [29].

Bonghan ductules were not surrounded by a basal lamina or by accessory cells, and the endothelial cell membrane of a ductule was not attached to extracellular matrix (ECM) fibres, as in lymphatic capillaries, where they preserve the functionality of the lymphatic vessels and capillaries when interstitial pressure rises, by preventing vessel collapse (Figure 6).

4.2 PVS in Ultra structural level [29]

This network has different fundamental features at the ultra-structural level. Even though the cytoplasmic progressions of Duct Endothelial Cells (DECs) made interdigitated and overlapping interconnections, the cell membranes of DECs did not present typical intercellular adhesive intersections. This indicates the weakness and looseness of interdigitated and overlapping cell membranes of DECs which might open under the pressure of flowing liquid and might permit leakage of large macromolecules, such as hyaluronic acid and albumin, which were identified in notable amounts in the rabbit's BHCs, using mass microscopy.

A PN is a small extended tissue of milky colour, measuring a few millimetres in length, and connected to thin clear PVs, themselves hard to separate with the naked eye or without staining with Trypan blue. Also, PNs and PVs were found situated in the peritoneum, but not involved with the internal organ surfaces. [29] "Figure 7"

4.3 Liquid of PVS and electrical charge transmission

An investigation of the liquid was conducted by BH Kim [30], and was found to contain significant modules, such as neurotransmitter hormones, and hyaluronic acids, such as free nucleotides, amino acids and adrenalin, and noradrenalin. An additional significant role of the liquid is the dispersion of electrical signs throughout the PVS system, which could provide a structure-based issue for the well-known phenomenon of low electrical obstructions at AP. [31] A hypothetical function of the liquid is light circulation, which may explain the almost immediate impressions felt throughout the entire body when some needling is conducted at AP. [23]

It has been noticed that more than 80% of the APs and 50% of the meridian intersections of the arm seemed to coincide with inter- or intramuscular connective tissue planes. [32-34]

4.4 Liquid flow direction

As is expected for a circulation system, a one-way flow was discovered. This was discovered by using a direct test to show liquid flow, done by injecting fluorescent nanoparticles into an organ-surface PN. [35] Recently, it has been shown that injecting Alcian blue into a PN on the surface of a rabbit liver, can measure the average flow speed [36] and in agreement with Bonhgan Kim's data it was 0.3 ± 0.1 mm/s. [30]

4.5 Excitable cells in a PN have Ca-ion channels

In one piece of research the influence of stimulation using acetylcholine and pilocarpine was determined and it was demonstrated that the outcomes were hyper depolarization, as has been seen in vascular smooth muscles. A crucial factor at the molecular level of such as system is the Ca-ion channels that are essential for cell movement in a contributable PN. The excitable cells in a PV have Ca-ion channels and this was confirmed by testing with the Ca-ion-blocker (nifedipine). [37]

4.6 Immune cells in the PVS

It has been observed that the organ-surface PN and PV included an important number of Monocytes, Mast cells, Macrophages, and Eosinophils. [19, 29, 38]

4.7 The intravascular PVS as hematopoietic organ

Blood cells are known to be generated in the bone marrow but Kim claimed that the intravascular BHD (PV) is another hematopoietic organ. [39] Indeed, we observed here that the PV became thicker and thus easier to detect when anaemia was induced by the injection of phenylhydrazine. Many Red Blood Cells in early stages of maturation were observed in organ-surface PNs when anaemia was induced. [39] It should also be noted that one study observed that in the histological sections there were no erythrocytes in the ductules. [29]

Another ingredient of the BHD structure which could be the most interesting part of Bonghan's theory may be the claim that Primo microcells (PMC) or micro-sized Bonghan microcells flow through PV [40,41]. PMCs were reported to have the pluri-potent ability to divide and differentiate into many kinds of cells in the same way that adult stem cells are able to do. [42]

4.8 The scattered cells and follicle like cells [43]

Histologically, a PN tissue contained different cell types, such as Monocytes, Granulocytes, and Small and large lymphocytes [27, 44], scattered randomly in the matrix as single cells or gathered in a follicle-like formation. The PN surface was not surrounded by a distinct connective tissue membrane or capsule and, inside or near follicle-like formations, there were several small channels or ductules. The ductule walls were formed by a thin single layer of endothelial cells and ductule diameters ranged from 7-15 μm, large enough to transport liquid and/or accommodate a single immune cell. "figure 6" In addition, H&E staining revealed that some ductules contained small basophilic bodies (（～1 μm) apparently composed of significant amounts of basophilic structures containing nucleic structures, such as chromatin [27,45], which were strongly stained by haematoxylin. [46-48]

4.9 PVS and Tissue regeneration

In one study, sliced PNs and PVs were stained with stem cell marker antibodies. It was observed that Mesenchymal Stem Cell (MSC) markers were strongly expressed in a manner similar to bone marrow. These protein profiles suggested that the role of PVS located on organ surfaces is as temporary depots and points of differentiation of stem cells for tissue regeneration. [16] "Figure 8"

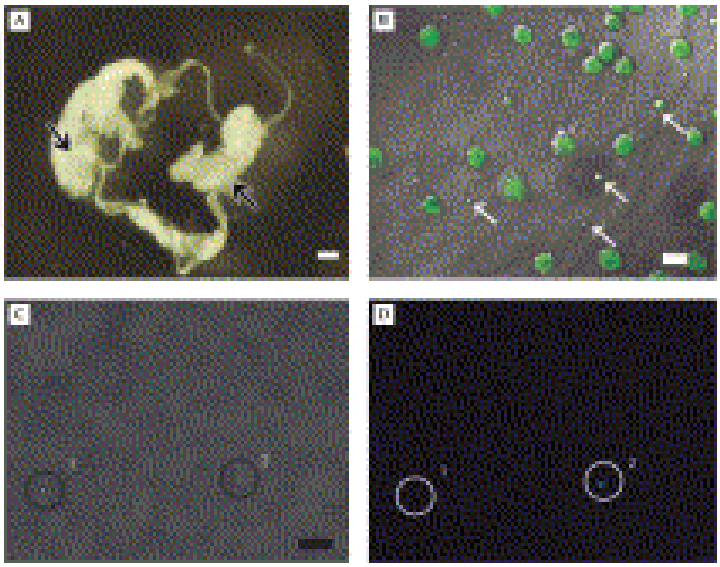

Figure 8. (A) Bonghan ducts on the surface of a rat's small intestine. (B) Macro and microcells naturally flowing out from Acridine orange stained cut; various sizes of microcells (arrows) stained among leukocytes. (C, D) Bonghan microcells (BH-MCs), 1-2 μm in size, separated by differential centrifugation, DNA-containing BH-MCs selected; two microcells, one on the right stained with Acridine orange. Scale bars, 10 μm for Figure B, D. "Reprinted with the permission of Professor Kwang-Sup Soh" [16]

4.10 SanAl, micro cells or granules and now Primo microcells (PMC)

The microcell or 'sanAl' (formerly called granule) is a spherical or oval-shaped body with a diameter of 1-2 μm and contains one or two chromosomes enclosed by a thin membrane. BH Kim claimed that the 'sanAl' played an important role in the regeneration of damaged tissues. [39,40]

4.11 Budding method as BH-MC replication [43]

While most of the PMCs had round shapes, some of the PMCs had a unique protrusion, appearing to be a swollen part; which was described by Kim as BH-MC budding. [40] According to his observations, initially the BH-MC (PMC) protrudes a thread and produces a daughter microcell from that thread, such that with proliferation, it forms a bundle of BH-MCs,(PMC) which then fuse to make a nucleus-like structure. Finally, the structure is enclosed by a membrane to form a cell. About 10% of the PMCs observed in scanning electron microscopic images showed such protrusions, having a threadlike structure 100 nm in diameter and 400 nm in length.

4.12 Sporosis

Sporosis is a cytological mechanism for micro-cell formation which is different to apoptosis and necrosis at the cellular level. They observed that microcells in cancer tissues were metabolically active, intensively accumulated nucleoproteins in their nuclei and cytoplasm, and transformed into young undifferentiated cells via rapid mitosis. The differences between PMCs and cancer tissue microcells are that PMCs are generated through normal physiology while Buikis' microcells were from pathological (tumour) tissues [43]. Buikis et al. observed that microcells in certain tumour tissues grew rapidly and transformed into young undifferentiated cells and called this the cytological mechanism for the immortality of tumour cell populations "sporosis" [49]. It has been conjectured that microcell-sporosis is actually nothing less than one of the 'sanAl' proliferation processes that normally occur in the PV system [50].

A direct relation of the PV system to tumour tissues has indeed been found. Cancer cells were subcutaneously injected into a mouse and PVs and PNs were observed in the fascia wrapping tumour tissue that grew in the skin [51], visualized by using the Trypan blue method. It has been hypothesized that, besides the well-known blood and lymphatic routes, PV connected to cancer tissue is a novel metastatic route [16].

4.13 Is energy stimulation by acupuncture True or False?

"A photon is an elementary particle, the quantum of light and all other forms of electromagnetic radiation, and the force carrier of electromagnetic force, even when static via virtual photons." The effects of this force are easily observable at both the microscopic and macroscopic level, because the photon has no rest mass; this allows for interactions at long distances. "Like all elementary particles, photons are currently best explained by quantum mechanics and exhibit wave–particle duality, exhibiting properties of both waves and particles". [52]

With the use of photomultiplier tubes, emissions of photons in the visible range have been readily detected from the liver [53], heart [54], lung [55], nerves [56], and muscles [57]. Recently, biophotons have been observed coming from human skin. [58, 59] This can guide to possible diagnostic applications [60] in connection with acupuncture. [23]

4.14 DNA as a source of biophotons

An excited atom or molecule emits light when an electron, having captivated a quantum of energy, is raised to a higher level of energy. Charge separation underlies the primary bioenergetic transduction processes associated with biological membranes, and the formation of excitons and their propagation are involved in energy transduction and in biocommunication. [49] A DNA molecule is an exciplex in which photons are stored and can be a source of biophotons. Exciplex formation in DNA has been shown in various conditions, even at room temperature. [23]

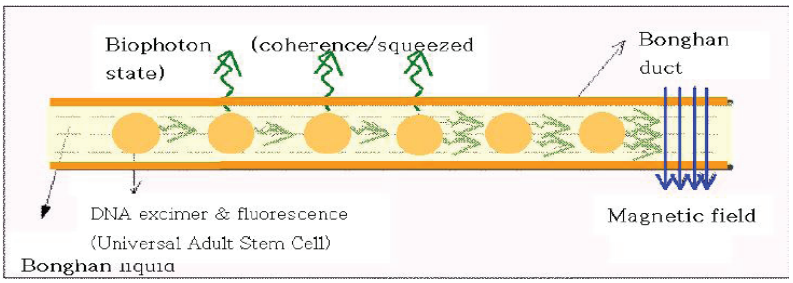

Figure 9. The optical channel model of biophotons in a Bong-Han Duct. DNAs are sources of coherent biophotons which propagate along the duct. (Schematic diagram) "Reprinted with the permission of Professor Kwang-Sup Soh".

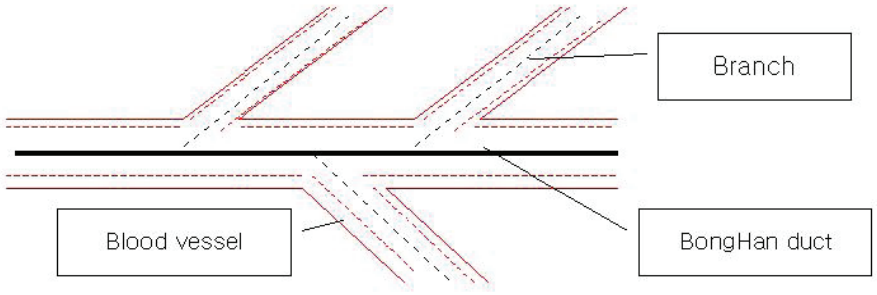

Figure 10. Bong Han Duct inside a blood vessel (schematic Diagram) "Reprinted with the permission of Professor Kwang-Sup Soh"

Non-coding DNA may act as a photon store and a coherent radiator, because of its enormous polymer size and its ability to form exciplexes. The resulting long-range electromagnetic waves and fields can be seen as the basis of several activities such as self-organization, mitosis and cell differentiation. The biophysical model for inter-and intra-cellular communication developed by Nagl and Popp [32] postulated that the biophoton is trapped and emitted by a cellular physical resonance device, namely DNA, which results in biophoton emissions with a high degree of coherence (Figure 9) [23].

To explain biologically this postulation regarding DNA and biophotons, we still need a network or channel. Bonghan's theory is similar to a channel and is just the answer. It provides the channels with the DNA granules running inside, and the channels are spread all over the body, linking the internal organs to the acupuncture points in the skin (Figure 10) [23].

Thus, we can understand the coherence of biophotons, and the regulation mechanism of the body as a "coherent body". This concept is the scientific foundation and base of acupuncture therapy and could bring about a new quantum communication paradigm based upon its biological role. [23]

Surely this concept is a new science and there are a lot of question to be answered, such as, does the reinforcing or reduction of acupuncture points have a placebo effect or a real effect? Is there any relationship between the channels of acupuncture or between the upper and lower parts of the body? There are many other critical questions which must be answered if we are to understand the mechanisms of acupuncture such as which organ or organs of the five elements are the source of the life cycle? What and where is SanJiao? What is the map of PVS? These and thousands of questions must be answered by futures research.

5. Conclusion and suggestions

DNA included in the PMC could be the source and storing place of biophotons which could be suggested to be called Qi. Based on this concept, any Qi (Biophotons) producing stimulators, for example, light (Laser or Infra Red ray), movement (massage), heat (Moxabustion) and needling, and so on, could stimulate the production of Qi. By having a wide web network, such as PVS, any point of body, which contains the PMC and DNA in it, could produce Qi (Biophotons), and this Qi could be distributed. If we were to have a map of PVS, this distribution could be controlled and Qi could be directed to target organs, which is the main purpose of acupuncture.

6. Acknowledgments

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