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PERSPECTIVES

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Correlations Between Fasciology and *Yin Yang* Doctrine

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Abstract
The aim of this study is to explore the correlations between fasciology and *yin yang* doctrine. Professor Yuan developed fasciology by three-dimensional reconstruction of connective tissue (fascia) in the trunk and limbs of the human body and tracing back to tissue origins in light of biological evolution and developmental biology. Fasciology states that the human body can be divided into two systems: the supporting-storing system and the functional system. This article elaborates on the roles of the two systems and their mutual relationship. The two systems are used to analyze the *yin*, the *yang*, and their relationship. The two systems are promoted but also restricted in different contexts. The supporting-storing system is formed by undifferentiated connective tissue and provides undifferentiated cells and nutrients for differentiated cells of the functional system. Thus, the supporting-storing system could be classified as quiet, similar to *yin*. The functional system continuously maintains the various functional activities of the human body. Thus, the functional system could be classified as active, similar to *yang*. In interpreting the *yin yang* doctrine from the point of view of fasciology, *yin* can be compared with the supporting-storing system and *yang* can be compared with the functional system.

1. Introduction

According to fasciology theory, first proposed by Professor Yuan in 2004 [1–3], the human body can be divided into two systems. One is a supporting–storing system consisting of undifferentiated nonspecific connective tissues including loose connective and adipose tissue. The other system is a functional system, which consists of a variety of differentiated functional cells and is surrounded and supported by the fascial frame of the supporting-storing system. The study of the biological properties of the fascial frame and the relationship between these two systems has been called fasciology or two-system theory. The human body is known to be composed of two parts, *yin* and *yang*, according to the famous *yin yang* doctrine of traditional Chinese medicine. Therefore, it is very likely that there is a close relationship between the two-system theory and *yin yang* doctrine. The aim of this article is to discuss this

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possible relationship and how the two systems of fasciology theory correspond with the two fundamental human aspects, *yin* and *yang*.

2. The *Yin Yang* Doctrine

The *yin yang* doctrine is one of the most important theories in traditional Chinese medicine. The regulation of *yin yang* changes has been used to explain the life activities of the human body and guide clinical practice in traditional Chinese medicine. According to this theory, movement, change, and the development of everything in the universe are influenced by *yin* and *yang*. According to the *Yellow Emperor's Internal Classic*, "*Yin* and *yang*, they are the way of heaven and earth, the fundamental principles governing the myriad beings, father and mother to all changes and transformations, the basis and beginning of generating and killing, the palace of spirit brilliance." In the *Xun Zi* it is noted, "myriad beings form when the heaven and earth meet together and all changes and transformations start when *yin* and *yang* meet together." The *Yellow Emperor's Internal Classic* notes that humans, as special organisms, also have bodies formed by *yin* and *yang*. Hence, the life activities of the human body are also regulated by *yin yang* changes [4].

Yang generally refers to that which is active, bright, up, or warm, and *yin* refers to that which is quiet, dull, down, or cold. For instance, the heaven is *yang*, the earth is *yin*; the sun is *yang*, the moon is *yin*; spring is *yang*, autumn is *yin*; summer is *yang*, winter is *yin*; daytime is *yang*, nighttime is *yin*; qi is *yang*, blood is *yin*; and fire is *yang* and water is *yin*. Therefore, *yin* and *yang* can be used as a standard to classify phenomena [5].

3. Fasciology (Two-system Theory)

The positions of three-dimensionally reconstructed fascial connective tissue in the trunk and limbs of the human body were found to be very close to the locations of meridians by Professor Yuan, as detailed in his 863 Plan of Digital Human Research, a National Basic Research Program of China [1,6–7]. In his subsequent work, the fascial connective tissues of the whole body were identified and three-dimensionally reconstructed, and a complete connective tissue frame that is consistent with the body contour was generated [2]. In considering evolution and developmental biology, the fascial connective tissues of the human body are structurally homologous to the extracellular matrix of a single germ layer organism, the mesoglea of a diploblastic organism, and the mesenchyme of a triploblastic organism. The common function of these different tissue layers is to provide nutrients and source cells for cell renewal, metabolism of functional cells, and maintenance of a stable internal environment [8]. The hypothesis of fasciology (two-system theory) was proposed by Professor Yuan, taking these similarities into account. In fasciology, the supporting-storing system consists of the fascia frame of undifferentiated mesodermal mesenchyme that remains after the differentiation of functional cells. The study of the biological properties of the fascial frame and the relationship between the aforementioned two systems has been called fasciology (Figure 1).

A new perspective on anatomy and fascial anatomy has also been proposed by Prof. Yuan [9]. In fascial anatomy, the human body is divided into only two major systems: the functional system and supporting-storing system (Figure 2). Fascial anatomy differs from traditional anatomy, which is studied according to nine functional systems (i.e., systematic anatomy) or according to different body parts (i.e., regional or topographic anatomy). Traditional anatomy includes only two axes: the morphological/function axis in systematic anatomy and the regional axis in topographic anatomy. A third axis, lifespan, is added in fascial anatomy. Therefore, fascial anatomy studies not only function and structure, but also studies morphological transformations during biologic evolution and embryonic development (Figure 3).

The fascial frame of the supporting-storing system is formed by undifferentiated stem cells. Its main function is to provide nutrients and cells for the functional system. In contrast, the functional system contains a variety of differentiated cells, and its main function is to maintain metabolism and life activities. Comparing the two-system theory to the *yin yang* doctrine, the supporting-storing system with its role of providing support and nutrition is *yin*, and the functional system with its active role of maintaining metabolism is *yang*. If the two-system theory is likened to a burning candle, the supporting-storing system is equivalent to the wax bar and belongs to *yin*, and the functional system is equivalent to the flame and belongs to *yang*.

4. Correlation Between the Two-system Theory and *Yin Yang* Doctrine

4.1. Correlation between the two-system theory and the mutual rooting of *yin* and *yang*

The mutual rooting of *yin* and *yang* refers to the fact that they are interdependent and rooted in each other. In other words, one cannot exist without the other, and the existence of one is the precondition

Step 1:

$$E = A + B$$

Step 2:

$$E_i = A_i + B_i$$

Step 3:

$$E = E_1 + E_2 + \ldots + E_{n-1} + E_n = \sum_{i=1}^{n} Ei$$

Step 4:

$$E = (A_1 + B_1) + (A_2 + B_2) + \ldots$$

$$+ (A_{n-1} + B_{n-1}) + (A_n + B_n) = \sum_{i=1}^{n} (Ai + Bi)$$

Step 5:

$$E = \sum_{i=1}^{n} Ei = \sum_{i=1}^{n} (Ai + Bi)$$

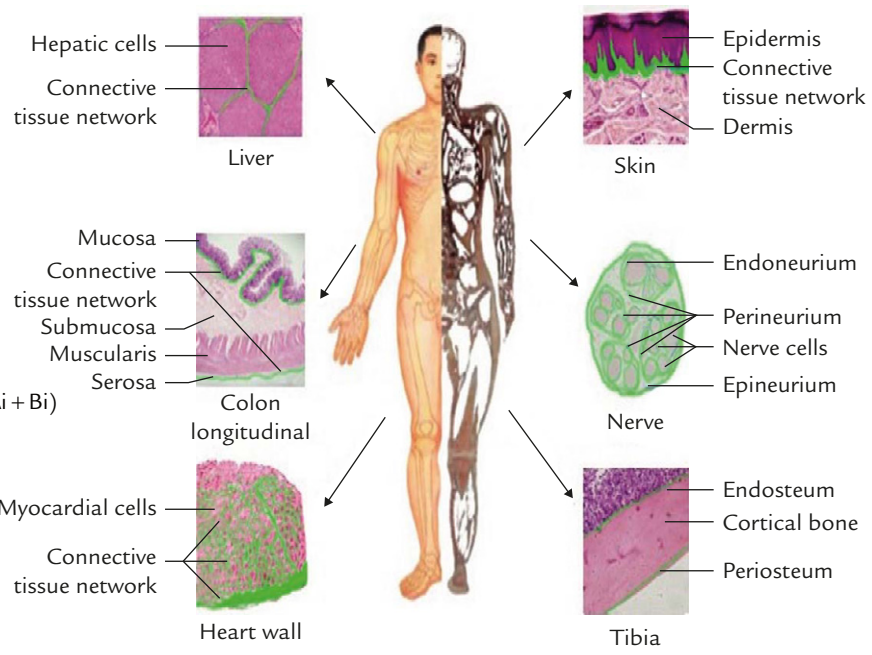

Figure 1 Schematic diagram depicting the human body (E) composed of two parts. One part is formed by the supporting-storing system (B), consisting of the frame of undifferentiated nonspecific connective tissues. The other part is formed by the functional system (A), consisting of various differentiated cells, which are surrounded and supported by connective tissues. The human body is made up of organs or regional structures (E_i), which in turn are composed of functional (A_i) and supporting-storing systems (B_i or the green). Overall, the human body (E) is composed of supporting-storing (A_i) and the functional systems (B_i) of various organs or regional structures (E_i).

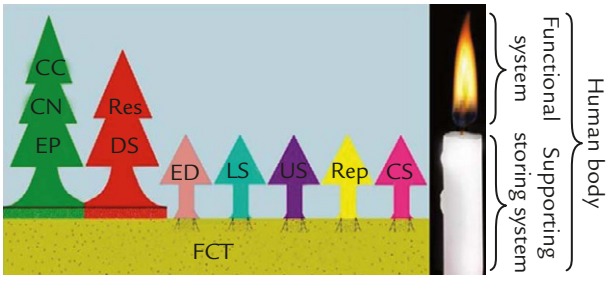

Figure 2 Schematic diagram depicting the human body divided into two major systems. One system is formed by a frame of undifferentiated nonspecific connective tissues, and the other is formed by a variety of functional cells. If the human body is likened to a candle, the functional system of the body is the flame and the supporting-storing system is the stick of the candle. FCT=fascial connective tissue; CC=functional cells of cerebral cortex; CN=functional cells of central nervous system; EP=epidermis; Res=functional cells of respiratory system; DS=functional cells of digestive system; ED=functional cells of endocrine system; LS=functional cells of locomotor system; US=functional cells of urinary system; Rep=functional cells of reproductive system; CS=functional cells of cardiovascular system.

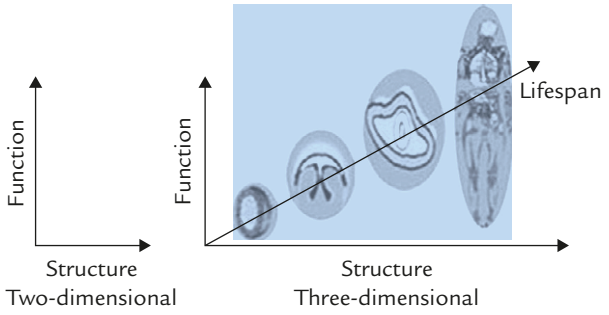

Figure 3 Schematic diagram showing the two-dimensional research model in traditional anatomy and the three-dimensional research model in fascial anatomy.

for existence of the other. *Yin* and *yang* are not only interdependent, but they also promote and interact with each other.

In the human body, the supporting-storing system and the functional system are also interdependent and mutually promote each other. Without the supply provided by the supporting-storing system, the normal structures and functions of the body cannot be maintained. Conversely, without the nutrients produced by the functional system, the supporting-storing system cannot maintain the cell sources necessary to renew functional cells. Continuous cell renewal in the supporting-storing system can further promote the production of nutrients by the functional system and vice versa.

If this interdependent and mutually supportive relationship is disrupted, both *yin* and *yang* will be impaired or even dissociate. For example, with the continuous consumption of functional cells in chronic diseases, undifferentiated stem cells are also worn

out. The weakening of undifferentiated stem cells leads to the dysfunction of both supporting-storing and functional systems. When the supporting-storing system is exhausted and can no longer support the functional cells, the organism will die. As noted in the *Classic*, "if *yin* and *yang* dissociate, the essence of *qi* will be exhausted."

4.2. Correlation between the two-system theory and *yin yang* opposition

Yin yang opposition refers to the mutually exclusive and restrictive nature of the two forces. Conflicts between *yin* and *yang* exist throughout the developmental process of all organisms. However, they also unify to a certain extent, which maintains the relative balance of *yin* and *yang* and promotes the development of organisms.

The supporting-restoring system and the functional system of the two-system theory can be compared with *yin* and *yang*, respectively. The former dominates stillness, and the latter dominates movements. The two systems are mutually exclusive and restrictive. The activity of functional cells will be inhibited if the supporting-restoring system fails to supply new cells and nutrition continuously. Similarly, the activity of undifferentiated stem cells will be inhibited if the functional system fails to provide new nutrients and maintain the appropriate microenvironment for stem cell metabolism. Therefore, the intercoordination of the two systems maintains the balance of the human body. As noted in the *Classic*, "only when *yin* is at peace and *yang* is compact, the essence-spirit is normal" [10].

4.3. Correlation between the two-system theory and the waxing and waning of *yin* and *yang*

The waxing and waning of *yin* and *yang* indicates that they are in constant motion. Normally, the *yin* and *yang* amounts vary to a certain extent with their movements.

The waxing and waning of *yin* and *yang* continue throughout the life of an organism. From birth to death, cells from the supporting-storing system continuously transform into functional system cells. The transformation leads to *yin* decline and *yang* growth. As functional cells produce nutrients and perform normally, they wear out and require replacement, which leads to *yang* decline and *yin* growth. Normally, the waxing and waning of *yin* and *yang* are in dynamic balance, which forms a state of peaceful *yin* and compact *yang*. However, if either the waxing or waning exceeds certain limits, the excess of *yin* or *yang* will lead to pathology. For example, osteoporosis is a metabolic disease caused by the inability of the supporting-storing system to supply enough osteoblasts to the functional system.

4.4. Correlation between the two-system theory and yin yang conversion

Yin yang conversion refers to the ability of *yin* and *yang* to transform into each other in certain conditions. As the *Classic* notes, "extreme *yin* transforms into *yang*, extreme *yang* transforms into *yin*" and "extreme cold engenders heat, extreme heat engenders cold."

During the human lifespan, the mutual transformation between supporting-storing and functional systems can be explained by the intertransformation of *yin* and *yang*. Undifferentiated stem cells in the supporting-storing system (*yin*) continuously differentiate into functional cells (*yang*), while functional cells (*yang*) restore undifferentiated stem cells (*yin*) by supplying nutrients.

During disease progression, this mutual transformation between the two systems still exists. For example, undifferentiated stem cells (*yin*) cannot differentiate into normal functional cells (*yang*) in a cancer patient. The lack of differentiation leads to the inability of functional cells (*yang*) to supply nutrients to stem cells (*yin*). The dysfunction of both systems results in cachexia. This is a good example of how a *yang* disease (cancer) becomes a *yin* disease (cachexia).

4.5. Correlation between the two-system theory and *yin yang* balance

Yin yang balance is commonly used to guide the basic research and clinical practice of traditional Chinese medicine. The *Huangdi's Internal Classic* notes, "The key factor of *yin* and *yang* is that only when *yang* is compact can it strengthen *yin*'s essence" and "only when *yin* is at peace and *yang* is compact, the essence-spirit will be normal." Throughout life in the human body, both *yin* and *yang* are dynamic and change constantly. In other words, they are in an unbalanced state with one increasing and the other decreasing [11].

In the two-system theory, the supporting-storing system and the functional systems constantly change in quantity and quality in the human body throughout life, just as *yin* and *yang* do. Although *yin* and *yang* are low in absolute quantity in children, the proportion of the supporting-storing system is higher than that of the functional system. Therefore, *yin* and *yang* are unbalanced, and *yin* exceeds *yang*. Because of this imbalance, undifferentiated stem cells differentiate into functional cells, and *yin* transforms into *yang* to achieve a *yin yang* balance. With

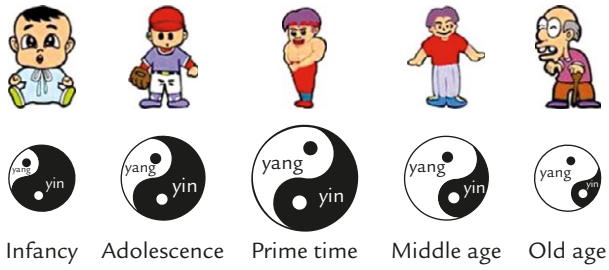

Figure 4 Schematic diagram of qualitative changes of *yin* and *yang*. *Yin* can be compared with the supporting-storing system, and *yang* can be compared with the functional system.

the increase in number and maturation of functional cells, the nutritional and active factors secreted from functional cells also increase, which further enhances the activities of the supporting-storing system. As a result, the body develops, grows, and shows greater vitality. In youth, the differentiated cells in the functional system are constantly replaced by differentiated stem cells from the supporting-storing system. This continuous replacement makes youth a period of *yin* waxing and *yang* waning until a final *yin yang* balance is achieved. Achievement of the *yin yang* balance is the peak period of life in which the body is strong and healthy. In the elderly, undifferentiated stem cells in the supporting-storing system become depleted, and the activities of differentiated cells in the functional system decrease over time. As a result, there is an excess of *yang*. In this situation, the functional cells are not adequately supported by stem cells, and *yang* is also damaged. As a result, the body functions gradually decline, and death ultimately results. As noted in the *Huangdi's Internal Classic*, "if *yin* and *yang* separate from each other, essential qi will be exhausted." Changes of *yin* and *yang* throughout life are summarized in Figure 4. In summary, *yin* exceeds *yang* in children, *yin* and *yang* are balanced in youth, and *yang* exceeds *yin* in the elderly.

According to an analysis of *yin yang* balance in the two-system theory, the authors believe that the processes regulating human *yin yang* balance in health care and treatment of disease regulate the balance between the supporting-storing system and functional system. The relative emphasis between the different systems should be distinct at different ages. In infants, undifferentiated stem cells in the supporting-storing system are abundant, whereas functional cells are relatively limited. Therefore, *yin* is abundant and *yang* is nonabundant. To achieve a balance, undifferentiated stem cells in the human body develop into various kinds of functioning cells, indicative of the waxing of *yin* and the waning of *yang*. In addition, both the differentiated cells of the functional system and the undifferentiated stem cells of the supporting-storing system are still viable and plentiful. Therefore, most diseases suffered during this period are called "excess diseases," in that they are the result of the overabundance of certain cell types. Therefore, treatments should focus on restoring balance between the supporting-storing system and the functional system. For example, when *yang* is in excess, the transformations of supporting-storing system cells into the functional system cells should be inhibited to achieve balance. In contrast, when *yin* predominates it is necessary to stimulate undifferentiated stem cells in the fascia frame to differentiate into functional cells. The supporting-storing system and the functional system are physiologically balanced in youth. Therefore, individual etiological factors should be taken into account, and different methods should be used to treat the condition and achieve a *yin yang* balance. In the elderly, undifferentiated stem cells in the supporting-storing system have decreased, resulting in a higher abundance of functional cells. As a result, *yang* is abundant, but *yin* is deficient. Furthermore, the activities of cells during this period of life are reduced, and the transformative ability of cells has declined. In addition, functional cells are less capable of secreting nutrition factors. Many diseases of the elderly are the result of such deficiencies. Hence, treatments should focus on nourishment and increasing the activities of functional and stem cells. For example, in a *yin* asthenia, ectogenic undifferentiated stem cells may be provided to nourish *yin*. In contrast, in a *yang* asthenia, *yang* should be strengthened by stimulating undifferentiated stem cells to facilitate transformation into functional cells. Simultaneously, the activities of various kinds of functional cells and stem cells should be stimulated.

5. Conclusions

The *yin yang* doctrine is extremely important in traditional Chinese medicine. However, it is difficult to understand *yin* and *yang* in the context of modern medicine. The authors attempt to link the *yin yang* doctrine to modern medicine using the two-system theory as a bridge. In the human body, *yin* can be compared with the supporting-storing system, which is composed of undifferentiated fascia frame, and *yang* can be compared with the functional system, which is composed of various differentiated functional cells. The whole body (E) is composed of the functional system (A_i) and supporting-storing system (B_i) consisting of various organs or regional structures (E_i). It is likely that the human body is formed by *yin* and *yang*. The link between the two-system theory and *yin yang* doctrine has provided modern medical evidence of *yin* and *yang*. Such an

understanding of *yin* and *yang* can be used as a guide for disease treatment. The balance between the two systems (or *yin* and *yang*) can be regulated with various methods, such as acupuncture, scraping, Chinese herbals, and physical exercise to stimulate the fascial connective tissue. In addition, the correlation between the two-system theory and *yin yang* doctrine may shed light on the future of fasciology.

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References

1. Yuan L, Yao DW, Tang L, Huang WH, Jiao PF, Zhong SZ, et al. A study on morphological basis of Chinese acupuncture and moxibustion from digital human body. *Jiepou Xuebao* 2004; 35:337–43. [In Chinese]
2. Wang J, Dong WR, Wang CL, Yao DW, Zhao BL, Yuan L, et al. From meridians and acupoints to self-supervision and control system: a hypothesis of the 10th functional system based on anatomical studies of digitized virtual human. *J South Med Univ* 2007;27:573–9. [In Chinese]
3. Yang C, Li DF, Dai JX, Yang HY, Yu MC, Yuan L, et al. Antiaging effect of allografting adipose-derived stem cells in rats. *Jiepou Xuebao* 2010;41:87–92. [In Chinese]
4. Mo GQ. How to understand the yin-yang and wuxing doctrine. *Chin Hydropower Med* 2008;2:106–7. [In Chinese]
5. Liu K, Liu N. Discussion of Yin-Yang Theory and Health in Chinese Medicine. *J Liaoning Univ Tradit Chin Med* 2010; 12:89–91. [In Chinese]
6. Jiao PF, Qiu XZ, Jiang N, Lu YT, Wang J, Yuan L. Morphological study of human meridian by building computer models of fascia. *Chin J Anat* 2006;29:487–9. [In Chinese]
7. Wang CL, Yuan L, Wang J, Jiao PF. Contrast study on the line course of fascia meridians made by three-dimensional reconstruction and classical meridians in human body. *Chin J Anat* 2007;30:340–3. [In Chinese]
8. Wang CL, Wu JP, Wang J, Yuan L. An interpretation on the essence of meridians and acupuncture mechanism from fasciology view. *Chin J Basic Med Trad Chin Med* 2008;14: 312–4. [In Chinese]
9. Bai Y, Yuan L, Soh KS, Lee BC, Huang Y, Yew DW, et al. Possible applications for fascial anatomy and fasciology in traditional Chinese medicine. *J Acupunct Meridian Stud* 2010;3:125–32.
10. Wang W. Health and anti-aging based on yin-yang balance. *Chin Mod Med* 2010;17:73–4. [In Chinese]
11. Tang YZ. The significance of the unbalance of yin-yang. *Guangming J Chin Med* 2010;25:1131–3. [In Chinese]