

## Perspective

# Convergence of Medicines: West Meets East in Newly-Discovered Organs and Functions

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**ABSTRACT** Although the foundations and evolution of Chinese medicine and Western medicine are very different, an increasing amount of research has revealed that those Eastern medicine principles practiced over thousands of years are confirmed by new technologies applied to the basic science of the human body. Recent scientific discoveries present enticing opportunities to reconcile Chinese medicine theories with Western biomedicine. Is there a trend toward the convergence of Eastern and Western medicine? Four studies which exemplify the potential for convergence are described in this article. The studies present findings in regard to mesentery, interstitium, a gut-lung axis, and lung-centered hematopoiesis, and were published recently in leading journals such as *Science*, *Nature*, and *Lancet*.

**KEYWORDS** convergence of medicines, mesentery, interstitium, gut-lung axis

In the 1950's, Dutch economist Jan Tinbergen asserted that planned economic systems and free market enterprise systems were immutably converging. In 1958, American economists Robert Dorfman, Paul Samuelson, and Robert Solow employed linear programming to demonstrate that there was a perfect duality between ideal computer-based simulations of optimal-market-equilibria planning and competitive-market outcomes where planners' and consumers' preferences were identical. These are models for a convergence theory of economics. Jan Tinbergen, Paul Samuelson, and Robert Solow all won Nobel prizes in economics. Tinbergen was the first Nobel laureate of economics in history.

This is not a paper about economic convergence. The increasing cutting-age medical studies afford a version of medical convergence. A case can be made that Eastern medicine and Western medicine are converging along pathways that derive from anatomy, physiology, pathology and pharmacology as they tap into understandings of human body. The four examples of basic research cited in this paper illustrate this convergence in medicines. As Western science refines its understanding of the human body, it is striking how often it seems to echo the theoretical constructions proposed several thousand years ago by Chinese medicine (CM).

### Mesentery vs. Triple Burner

What is an internal organ? It is a relatively independent part of the body with cells and tissues that carry out one or more special functions. Most medical dictionaries define it this way. How many organs are there in the human body? Until 2017, the rather surprising medical consensus was 78. Last year the experts added one more organ to the count for a new total of 79. Gray's Anatomy has updated that figure, and might update again soon.

Thanks to Irish surgeon Calvin Coffey,<sup>(1)</sup> the mesocolon has been reclassified as a single organ, and is the new 79th addition. These discoveries have been of interest to several experts on acupuncture, who have proposed the idea that the mesocolon structure shows a strong correspondence to the CM concept of the "triple burner" (San Jiao).

The peritoneum is a serous membrane lining the abdominal cavity. Mesentery tissue derives from folds of the peritoneum, and has a number of functions, including holding the abdominal organs in place. The mesocolon

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is now understood as a continuous tissue structure running from the stomach to the rectum. Using new microscopic and electron microscopic examinations, Dr. Coffey established the mesocolon as one single structure deriving from the duodenojejunal flexure and extending to the distal mesorectum layer. Previously, it was thought to be made up of lots of separate parts, and was described as a fragmented structure with all its named parts — the ascending, transverse, descending, and sigmoid mesocolons, mesoappendix, and mesorectum — separately terminating their insertion into the posterior abdominal wall.<sup>(1)</sup>

Reclassifying the mesentery/mesocolon enables innovations in the fields of colon and rectal surgery, and in sciences related to anatomy and physiology. Mesentery tissue functions to store fat, and allows blood vessels, lymph nodes and vessels, and nerves to supply the intestines. Categorizing abdominal diseases in terms of this organ may allow doctors and scientists to reframe diseases such as colorectal cancer, inflammatory bowel disease, diabetes and obesity.

Responding to discoveries about the mesocolon, acupuncture authority Li YM<sup>(2)</sup> wrote, "If mesentery had been recognized as an independent organ earlier, it is very possible that mesentery could be used to translate "triple burner" in CM. What Hua Shou drew in his Zang-Fu chart connecting the intestines and other organs (published during the Yuan Dynasty) is exactly the mesentery." This opinion was reinforced by expert Jin GY,<sup>(3)</sup> who said "That mesentery is the triple burner is definite and specific. This discovery presents us a scientific name for triple burner."

### Interstitium vs. Meridians

Next, we will consider another new discovery related to the body's connective-tissue system. In 2018, a breakthrough tissue analysis by Benias, et al<sup>(4)</sup> paved the way for the interstitium to be considered for classification as the 80th organ of the body. Science has long recognized that there is "extracellular fluid" in our bodies which is not contained in lymph or blood vessels. The tissue containing extracellular fluid was thought to be a solid, dense, connective tissue layer, but has now been found to be a complex network of fluid-filled cavities that are strong and flexible, yet so tiny and indistinguishable that they escaped the attention of anatomists for many decades. What medical textbooks had defined as "dense connective

tissue" were actually fluid-filled structures that only appeared to be densely compacted when tissues were made into slides, with fluid draining away, and collagen lattice collapsing onto itself. Fixing the tissue with chemicals for examination on slides would dry out the tissue, causing the cavities to collapse. It was therefore thought that these connective tissue layers were solid.

Benias, et al<sup>(4)</sup> published a study in Scientific Reports (March 27, 2018) in which they present evidence for this tissue called "interstitium" to be a new possible organ. The interstitium is a thin layer of connective tissue throughout the body, including lining the digestive tract, the lungs, and even the surrounding blood vessels. This lining consists of collagen fibers, fibroblasts, CD34 cells, and fluid filled pockets/cells. It is a distributed system of fluid-filled cavities in the connective tissue. The fluid itself appears rich in proteins typical of lymphatics and serum, but the space is neither lymphatic nor vascular. The fluid is lymph, which means that these cavities likely play an important role in the immune system. They also give the skin and connective tissue a spongy structure, which tends to make them more flexible and durable, functioning to absorb shocks and bumps, and holding all the organs in place. Recent discoveries have shown that this layer is much more complex than original thought. Dr. Theise points out that this new organ is the largest organ of the body by volume — even larger than that of skin due to its wrapping around every organ, including the skin.<sup>(5)</sup>

A speculation regarding interstitium is that it serves as a possible pathway for disease mechanisms. As interstitium is in direct communication with the lymphatic system, the interstitium's system of fluid-filled backroads could explain the metastasis of cancer cells and their quick spread beyond the limits of the organ in which the cancer started. Unraveling the mechanics of the interstitium could change the way we understand everything from cancer to acupuncture to inflammation.

Interstitium, viewed as part of the fascia system, has been posited as the supporting network of the meridian system in acupuncture and CM. Dr. Theise himself has emphasized that interstitium might explain how acupuncture works, and that the therapeutic effects of energetic healing "jolts" may be traced to the interstitium.<sup>(5)</sup> Prof. Langevin HM, et al<sup>(6)</sup> of Harvard

Medical School has also been involved in research on fascia and fascia's possible role in explaining qi sensation from acupuncture stimulation.

### Gut-Lung Axis vs. Lung/Large Intestine Connection

In the January 5, 2018 issue of *Science*,<sup>(7)</sup> researchers found a new link between the lung and the intestines through type 2 innate lymphoid cells (ILC2). ILC2s derive from a common lymphoid progenitor and belong to the lymphoid lineage. Researchers have demonstrated that ILC2s can be recruited from the gut to the lung and other organs in response to inflammatory signaling. This ILC2 gut-lung axis becomes vital for understanding the link between disturbances in the intestinal microbiota and lung diseases such as asthma and chronic obstructive pulmonary disease (COPD). Increasing evidence shows an extraordinarily intimate relationship between the gastrointestinal tract and the respiratory tract.<sup>(8)</sup> Studies demonstrated that changes in microbial composition and function in the respiratory tract and the gut have been linked to alterations in immune responses and to disease development in the lungs. These studies prove that exacerbations of chronic gut and lung disease share key conceptual features with the disorder and dysregulation of the microbial ecosystem. Scientists<sup>(9)</sup> speculate that although the gut-lung axis is only beginning to be understood, these studies indicate that there is potential for manipulation of the gut microbiota in the treatment of lung diseases.

That the lung and large intestines have an interior/exterior connection is a major theoretical construct of CM. These two organs are functionally interconnected in CM physiology, which implies that lung diseases can be treated from the large intestine perspective, and that large intestine diseases can be treated from the lung perspective. The gut-lung axis discovered in this research provides new evidence to back up this ancient principle of Eastern medical practice.

### Lung-Centered Hematopoiesis vs. Qi/Blood Relationship

Platelets are pieces of cytoplasm that are derived from the megakaryocytes of the bone marrow. They are critical to hematological functions such as hemostasis, thrombosis, and inflammatory responses. Medical science has long held that megakaryocytes, and therefore platelet production, are normally

centered exclusively in the bone marrow. A recent study by scientists Lefrançois, et al<sup>(10)</sup> published in *Nature* provides evidence that the lung is involved to a large degree in platelet biogenesis. The study describes a distinct mechanism of proplatelet release from intravascular megakaryocytes of extrapulmonary origin in the lung microcirculation. Researchers employed state-of-the-art technology for imaging lung microcirculation such as two-photon microscopy, *in vivo* lineage-tracing techniques, and sophisticated lung transplants. Careful analysis of the resulting data revealed that the lung is also a primary site for platelet production. In fact, lung megakaryocytes can completely reconstitute platelet counts in the blood of mice with thrombocytopenia. They discovered that a large number of megakaryocytes circulate through the lungs where they dynamically release platelets. These platelet-releasing megakaryocytes are of extrapulmonary origin, such as the bone marrow, where large megakaryocytes were observed migrating out of the bone marrow. Furthermore, the researchers discovered that the lung's contribution to platelet biogenesis is substantial, with approximately 50% of total platelet production, as well as identified populations of mature and immature megakaryocytes, along with hematopoietic progenitors that reside in the extravascular spaces of the lung. When there is a disease condition of thrombocytopenia and relative stem cell deficiency in the bone marrow, these progenitors can migrate out of the lung, repopulate the bone marrow, completely reconstitute blood platelet counts, and contribute to multiple hematopoietic lineages.

These new discoveries citing the lung as a primary site of terminal platelet production and an organ of hematopoiesis have implications for the treatment of disorders<sup>(11)</sup> such as lung inflammation and other inflammatory conditions, bleeding and thrombotic disorders, and transplantation.

This study has a resonance with the traditional understanding of lung dynamics in CM. In CM theory, the fluid generated from food digestion in the spleen and stomach is supplied to the Lung collaterals, where the fluid and "clear qi" are combined and transformed into blood. Lungs control all the body's collaterals and qi. The dynamic qi and blood circulation depend on the dissemination and regulation of Fei (Lung) qi. Since qi both generates and controls blood, it is a

commonly-used treatment strategy in CM to generate and control blood by tonifying qi.

### Conclusion

The four studies discussed in this paper either discovered new organs, revealed new functions of existing organs, or established a new relationship among organs. These new scientific discoveries and the evidence that substantiates them are completely congruent with theoretical principles which have guided CM for thousands of years. It seems that CM is becoming more relevant by adopting principles of modern Western medicine, while Western medicine is systematically validating Eastern medicine principles. Only time will tell whether these apparent trends toward medical convergence are a false pattern or an objective reality.

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