

Kwang-Sup Soh · Kyung A. Kang
David K. Harrison *Editors*

The Primo Vascular System

Its Role in Cancer and Regeneration

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Editors

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**Group Photo of ISPS 2010
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Preface

The first International Symposium on Primo Vascular System 2010 (ISPS 2010) with special topics on cancer and regeneration was held in Jecheon, Korea during September 17–18, 2010.

The ISPS 2010 was devoted to topics related to biomedical findings on Primo Vascular System (PVS) that may be the anatomical structure corresponding to acupuncture meridians. Bong-Han Kim, in the early 1960's, published his discovery on a new, web-like vascular system. Unfortunately, his research results were not reproducible by others because he did not reveal the dye used in his study and thus neglected for a long time. In 2002, the Biomedical Physics Laboratory in the Department of Physics and Astronomy, Seoul National University launched a new PVS research project utilizing modern biomedical imaging techniques. Kim's claims were confirmed by the new study results, and functional aspects of PVS including its roles in the areas of regenerative medicine and cancer have been uncovered. The research results have also suggested the extensive roles of PVS in human, changing paradigm of medicine. With an expectation of Kim's claim, "PVS is acupuncture meridian" to be proven soon, the future PVS research may reveal the mechanisms of traditional oriental medicine practiced for several thousands years.

The symposium dealt with the past findings, current status, and future prospect of the PVS research in the context of cutting-edge investigation in oriental and occidental medicine, molecular biology, and biophysics. The symposium provided a FIRST international opportunity to exchange the research results on PVS among multidisciplinary experts. We are also happy to announce that, in August 2010, the International Society for Primo Vascular System (ISPVS) was formed.

The ISPS 2010 had 43 oral and 40 poster presentations and approximately 200 participants. The organizing committee would like to express our appreciation to the invited speakers, presenters, participants, and those who helped the symposium in

various ways to make it very successful. We are also grateful to the authors who submitted manuscripts to this historic volume on PVS. We sincerely hope that we do not have to wait too long to have the second ISPS symposium.



Seoul, Korea

Kwang-Sup Soh





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Contents

Part I Past, Present and Future of Primo Vascular System Research

1 A Brief History of the Bong-Han Theory and the Primo Vascular System	3
Kwang-Sup Soh	
2 Summary of Bong-Han Kim’s Publications	7
Jungdae Kim, Jonghyun Jung, and Michael Potroz	
3 A Follow-up Study on the Morphological Characteristics in Bong-Han Theory: An Interim Report.....	19
Satoru Fujiwara and Sun-Bong Yu	
4 Recollection of Early Research on Primo Vascular System: Ultimate Implication of Bong-Han Theory	23
Jong-Su Lee	
5 Current State of Research on the Primo Vascular System.....	25
Kwang-Sup Soh	
6 Primo Vascular System: Basic and Applied Research Outline.....	41
Michael Potroz and Kwang-Sup Soh	
7 The Primo Vascular System: Facts, Open Questions, and Future Perspectives	47
David K. Harrison and Peter Vaupel	

Part II Primo Vascular System in Various Organs

8 Structure of the Sinus in the Primo Vessel Inside the Bovine Cardiac Chambers 57
 Byung-Cheon Lee, Hong Bae Kim, Baeckkyoung Sung, Ki Woo Kim, Jamin Sohn, Boram Son, Byung-Joon Chang, and Kwang-Sup Soh

9 Finding a Novel Threadlike Structure on the Intra-abdominal Organ Surface of Small Pigs by Using In Vivo Trypan Blue Staining..... 63
 Ayati M. Hossein, Tian Yu-Ying, Huang Tao, Zhang Yu-Qing, Che Yong-Zhe, and Zhang Wei-Bo

10 Observation of the Primo Vascular System on the Fascia of Dogs 71
 Zhaofeng Jia, Kwang-Sup Soh, Qiang Zhou, Bo Dong, and Wenhui Yu

11 Development of the Putative Primo Vascular System Before the Formation of Vitelline Vessels in Chick Embryos 77
 Seung-Yoon Lee, Byung-Cheon Lee, Kwang-Sup Soh, and Gil-Ja Jhon

12 Characterization of Primo Nodes and Vessels by High Resolution Light Microscopy 83
 Vitaly Vodyanoy

13 Distribution of Primo Vessels in the Mesentery of a Mouse..... 95
 Zhendong Su, Ping An, Jeong-No Lee, and Kwang-Sup Soh

14 Primo Vessels in the Mesentery of Nude Mice..... 101
 Ping An, Zhendong Su, Hesheng Luo, and Kwang-Sup Soh

15 Comparison of the Primo Vascular System with a Similar-Looking Structure..... 107
 Cheon-Joo Choi and Chae-Hun Leem

16 Effect of the Primo Vascular System on Liver Tissue Recovery After Irreversible Electroporation: A Preliminary Study..... 115
 Hong-Bae Kim, Chang-Kyu Sung, and Saeyoung Ahn

17 Detection of the Primo Vessels in the Rodent Thoracic Lymphatic Ducts 121
 Inho Choi, Hee-Kyoung Chung, and Young-Kwon Hong

18 Histological Comparison of Primo Nodes in Abdominal Membrane and Lymph Nodes of Rat 127
 Kyoung-Hee Bae, Zhendong Su, Kwang-Sup Soh, and Hee Min Kwon

19 Visualization of the Primo Vascular System by Using Trypan Blue in the Subarachnoid Space of Rats..... 133
 Inhyung Lee, Zhen-dong Su, Ki Woo Kim, Byung-Cheon Lee, and Kwang-Sup Soh

20 Network of the Primo Vascular System in the Rat Hypodermis 139
 Byung-Cheon Lee, Zhendong Su, Baeckkyoung Sung, Ki Woo Kim, Jin-Myung Cha, Jin-Kyu Lee, Byung-Joon Chang, and Kwang-Sup Soh

Part III Primo Microcell (SanAI) and Stem Cells

21 Identification and Characterization of Small Stem-Like Cells in the Primo Vascular System of Adult Animals..... 149
 Vyacheslav Ogay and Kwang-Sup Soh

22 Membrane Mechanical Property of Primo Microcells..... 157
 Ku Youn Baik, Chang Ho Kim, Suk Yi Woo, Sae Chae Jeoung, and Kwang-Sup Soh

23 Primo Microcell in a Primo Node as a Possible Origin of Adult Stem Cells 163
 Seong-hun Ahn, Sung-won Lee, Sung-Yeoun Hwang, Jae-hyo Kim, and In-chul Sohn

24 Budding Primo Microcells (Sanals) in a Culture Medium with Fertilized Egg Albumen and RPMI Medium..... 171
 Byung-Cheon Lee, Dae-In Kang, and Kwang-Sup Soh

Part IV Cancer

25 Identification of Primo Vascular System in Murine Tumors and Viscera 179
 Walter Akers, Yang Liu, Gail Sudlow, Joon Lee, Jung Sun Yoo, Byung-Cheon Lee, Kwang-Sup Soh, and Samuel Achilefu

26 Molecular Compositional Differences of the Primo and the Lymphatic Vascular Systems in Murine Melanoma Models..... 185
 Jung Sun Yoo, Baatartsogt Oyungerel, Il Young Han, Ji Young Kim, Choong Hwan Lee, Kang Duk Choi, Kwang-Sup Soh, and Tae Young Han

27 Using Human Observations to Gain Biologic Insights and New Treatments; Discovery of a Quadruplex-Forming DNA Aptamer as an Anticancer Agent..... 193
 Donald M. Miller, Shelia D. Thomas, Kara Sedoris, Ashraful Islam, David Muench, Cortney Clarkson, and Charles A. Koller

28 Translational Development of Therapeutic Vaccines for Lymphoma 203
 Larry W. Kwak

29 Oxygen Transport to Tumors: Pathophysiology and Clinical Implications 207
 Peter Vaupel

30 Stress Responses of Pancreatic Cancer Cells and Their Significance in Invasion and Metastasis..... 213
 Yoshiharu Motoo, Qi-Sheng Xia, Naoki Nakaya, Takeo Shimasaki, Hideo Nakajima, and Yasuhito Ishigaki

31 Human Urine Extract (CDA-2) Eliminates Cancer Stem-Like Cells and Inhibits Metastasis: Its Potential Role on the Microenvironment of Primo Vascular System 219
 Chih-Jung Yao, Ping-Hsiao Shih, Chi-Tai Yeh, and Gi-Ming Lai

Part V Imaging, Oxygen, Physiology and Others

32 Mapping PVS by Molecular Imaging with Contrast Agents..... 227
 Kyung A. Kang

33 Unusual Optical Properties of Collagen and Implications for the Primo Vascular System 235
 Eduard van Wijk, Margo Groeneveld, Jan van der Greef, and Roeland van Wijk

34 Basic Electrophysiological Properties of Cells in the Organ Surface Primo Vascular Tissues of Rats..... 243
 Jae-Hong Choi, Tae Hee Han, Chae Jeong Lim, So Yeong Lee, and Pan Dong Ryu

35 Effects of Cholinergic Drugs on Membrane Potential of Cells in Organ Surface Primo Nodes 251
 Sang-Hyun Park, Byung-Cheon Lee, Cheon-Joo Choi, Kwang-Sup Soh, and Pan Dong Ryu

36 Apoptotic Cardiomyocyte Beating Frequency Detected with Optical Intensity Fluctuation Spectrometer 263
 Svetlana Norina, Byung Cheon Lee, Jungdae Kim, and Ku Youn Baek

37 PKA Activation in Cardiac Myocytes Affects the Voltage Dependence of Na-K ATPase Pump and Na-Ca Exchange Currents Differently..... 271
 Chin Ok Lee and David C. Gadsby

38 Bioimaging of Stem Cells, Live Tissue, and Whole Animals Using Diversity-Oriented Fluorescence Library Approach.....	285
Young-Tae Chang	
39 The Clinical Application of Optical Spectroscopy in Monitoring Tissue Oxygen Supply Following Cancer Treatment.....	291
David K. Harrison	
Part VI Acupuncture	
40 Oriental Medicine in Japan, Lymphology and the Primo Vascular System.....	299
Moriya Ohkuma	
41 From the Anatomical Discovery of Meridians and Collaterals to Fasciaology Theory.....	305
Yu Bai, Lin Yuan, Yong Huang, Chun-lei Wang, Jun Wang, Jin-peng Wu, Jing-xing Dai, Dong-fei Li, Chun Yang, Mei-chun Yu, Hui-ying Yang, Hui Tao, Ou Sha, and David Tai Wai Yew	
42 An Evidence-Based Review of Acupuncture as an Adjunctive Therapy in Comprehensive Cancer Care.....	319
Christopher Zaslawski	
43 Thermal Characteristics of Moxibustion and its Implication to Primo Vascular System.....	327
Seung-Ho Yi, Moo-Won Park, and Hye-Jung Lee	
Index.....	335

Part I
Past, Present and Future of Primo
Vascular System Research

Chapter 1

A Brief History of the Bong-Han Theory and the Primo Vascular System

Kwang-Sup Soh

Abstract A short history of the Bong-Han theory is presented. The original work by Bong-Han Kim in the Kyung-Rak Research Institute of North Korea in the early 1960s is described. The follow-up research by Fujiwara in Japan is briefly mentioned. Modern development since the rediscovery of the primo vascular system by the Seoul National University team is given in chronological order.

Bong-Han Kim was born in 1916, and graduated from the College of Medicine Seoul National University in 1941. He was an Associate Professor at Pyung Yang Medical School, Physiology Laboratory, when he announced his discovery of anatomical structures corresponding to acupuncture points and meridians at the Symposium at the Pyung Yang Medical School on August 18, 1961, which he published in 1962. There was no description of the method how the structures were found or identified.

The epoch-making discovery was made sometime between 1962 and 30 November 1963, when he published his second report as the director of the Kyung-Rak Research Institute (KRI). This Institute was known to be a National Institute of North Korea and was probably established in this period. The publications in the name of Bong-Han Kim were reports on the collective works of researchers in this Institute. Unlike journal papers, these reports did not have “Method” or “Materials” sections. In that paper, which was the second among a series of five articles with the name of Bong-Han Kim, he mentioned that he found the most important material, a blue tracing dye which revealed not only acupuncture meridians but their extensions into the body. Thereafter, his team established the existence of a new circulatory system running throughout an animal’s body. This second paper was translated into

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English and other languages and distributed in most world-class libraries. The KRI published a third report which was a systematic investigation of the new circulatory system.

The fourth and the fifth reports in 1965 were about the “Sanal”, which was a kind of microcell whose function was similar to embryonic-like stem cells in modern terminology. They described regeneration of damaged liver tissues and hematopoiesis via Sanals.

For some unknown reasons, the KRI was closed around 1966, and no official or any reliable sources gave any hint on the fate of Bong-Han Kim and other researchers of the Institute. Until to the present time, no traces have been found of the KRI or of Kim and his team.

The historical discovery of Bong-Han Kim in 1963 was widely publicized in daily newspapers of China, Japan, and Russia, and many teams tried to reproduce his results. Strangely enough, there was no record that any of them requested the mysterious staining blue dye of Bong-Han Kim, which was essential to confirming his results. It is not surprising at all that no one was able to either prove or disprove his claims.

Only one Japanese researcher, Satoru Fujiwara, who was an Assistant Professor of Anatomy at Osaka City University, was stubborn enough to observe the primo vascular system (PVS) in blood vessels and on the surface of organs of rabbits. He produced one journal article in 1967 and published a book, “Discovery of Acupuncture Meridian”, both in Japanese. He recalled that it took nearly 6 months to find the (PVS) in his own way without knowing Kim’s secret blue dye. His results were limited only to a few subsystems of the whole PVS, and he could not continue his research as people in Japan were sceptical of his pursuit after Kim’s fall in North Korea. He opened a dental hospital on a small island near Osaka, but he kept his work records.

In the year 2002, Kwang-Sup Soh invited a Chinese veterinary student, Jiaowen Jiang, to begin a trial experiment for the test of Kim’s claim on the existence of threadlike structures (primo vessels) in the large blood vessels of rabbits. In that summer (July–August), the task force team of Jiang was able to find the intra-vascular primo vessel, which was the start of PVS research. Obtaining long enough pieces of primo vessel from blood vessels for physiological analysis was not so easy; searching the PVS on organ surfaces seemed to be a better target for the analysis, and the SNU team spent nearly half a year observing them. After repeated failure, Soh looked for Professor Fujiwara and finally visited him in Osaka. Fujiwara kindly gave Soh the records of his research and a film showing experimental procedures.

Viewing the film gave momentum to efforts to observe the PVS on organ surfaces in the abdominal cavity, and further observations in other organs, such as in lymph vessels were successful. However, finding the PVS in other organs was not possible, so efforts to find the PVS in the whole body seemed impossible without Kim’s secret blue dye.

A breakthrough occurred in November 2008 with the discovery of the Trypan blue technique by BC Lee, with which the weblike network of the PVS was observed in the omentum of a rat and in adipose tissue. The most striking progress was

discovery of the PVS around cancer tissue with the Trypan blue technique, which attracted much attention from cancer researchers. The PVS around cancer tissue was not mentioned in Kim's or Fujiwara's works. Another great leap was the finding of the PVS floating in cerebrospinal fluid in the brain ventricle and the central canal of the spinal cord. This PVS can be visualized by injecting fluorescent nanoparticles into the lateral ventricle of the brain of a rat. The current goal is to find the PVS route from the skin to the brain via the peripheral nerve and spinal cord, which can be used for the diagnosis and the treatment, at the acupuncture point, of brain diseases, such as Alzheimer's disease or Parkinson's disease.

In September 17–18, an International Symposium of Primo Vascular System (ISPS 2010) with special topics on cancer, regeneration, and acupuncture was held in Jecheon, Korea. The topics suggested that the PVS was deeply related to cancer, regeneration/stem cells, and imaging of the acupuncture meridian. Based upon the detection techniques developed by the SNU group, applied research to gain a basic understanding of the PVS can be started, which is the second phase of the PVS research.

Chapter 2

Summary of Bong-Han Kim's Publications

Jungdae Kim, Jonghyun Jung, and Michael Potroz

Abstract We present a summary of the Bong-Han Kim's publications. His five articles were published in Korean in the *Journal of Jo Sun Medicine* from 1962 to 1965. The subjects of articles are about the studies on the reality of acupuncture meridian, the Kyungrak system, and the Sanal theory. Only the concluding parts of the articles were translated in English.

There were five articles published in the name of Bong-Han Kim. They were not research articles in a proper form but a kind of report of the Institute of Acupuncture Meridians which was a national research institute of the North Korean government, and of which Kim was the Director. Therefore, they had no "Materials and Method" sections and only described results. No "Analysis" or "Discussion" sections were given. These reports were all written in Korean but the second article was translated into English, Chinese, Russian, and Japanese, and was distributed to major libraries throughout the world. We have translated the "Conclusion" section of each article and present them here.

1 Study on the Reality of Acupuncture Meridian: *J Jo Sun Med 1962;9:5–13*

1.1 Conclusion

We found the physical substrate of acupuncture points (AP) and meridians (AM) by applying novel methods.

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1. In general our findings of APs were in agreement with the position of classical APs of traditional oriental medicine. There were some new points which were different from the classical APs.
2. The AM is a bundle of vessels. They are distinctively different from the nervous, blood, or lymphatic systems with respect to histological and physiological properties.
3. The physical substrate of AMs is a novel anatomical system which has not been known until the present time.

2 On the Kyungrak System (Primo Vascular System): *J Acad Med Sci DPR Korea 1963 Dec 10;90:1-41*

2.1 General Conclusion

All the results of a series of above-mentioned experiments on the Kyungrak system (primo vascular system (PVS)) show that the PVS is another, independent functional-morphological system.

1. The PVS consists of the primo nodes (Bonghan corpuscles) and the primo vessels (Bonghan ducts) linking them.

The primo nodes exist not only in the skin but are widely distributed in the profunda of the organism as well.

This coincides also with the experiences gained in the clinical acupuncture.

In structure, however, the primo node in the skin (superficial primo node) is different from the profound primo node deep in the body.

The superficial primo node consists of the outer layer of smooth muscles and the inner substance made of various cells.

It is considered that this muscle layer is important in sending secretion to the primo vessel.

It is also considered that there are various kinds of cells in the inner substance and they perform the secretory function.

The results of histochemical and biochemical study prove that the inner substance has an abundance of nucleic acids, particularly DNA.

In the profound primo node, specific cells are arranged in a definite order and materials, which are basophilic like the nucleus and varied in form, some rod-shaped and others thread-shaped, are irregularly located.

These materials are arranged in the same direction as the path of the primo vessel and their DNA reaction proves positive histochemically. This is related to the fact that high concentration of DNA is contained in the primo vessel. The above-mentioned profound primo node has no outer muscle layer.

The structure of the primo node is completely different from the other structures hitherto known.

2. The primo vessel has two forms of existence.

One of the forms of its existence is that it runs inside the blood vessel or the lymphatic vessel and the other is that it runs outside the vessel.

The intravascular primo vessel and the extravascular primo vessel take different directions from each other, but there is no difference between them in structure.

The primo vessel comprises bundles of the primo lumens.

The primo lumen is very soft and has a thin wall, which consists of endothelial cells of a single layer. It is difficult to discern clearly the internal structure of the nucleus of the endothelial cell by applying the usual staining method. It is of a peculiar rod shape.

The contents of the primo lumen often appear in the shape of granule when they are stained by a routine method. Moreover, it has been established by cytochemical reaction that it contains DNA.

The contents of the primo vessel are entirely different from those of the blood and lymphatic vessels. When stained with acridine orange, the primo vessel brightly fluoresces in yellowish green.

This also clearly distinguishes the primo vessel from other tissues.

Examination under a phase-contrast microscope of the primo vessel in the fresh specimen reveals that it has nuclei of a peculiar form and arrangement.

The superficial primo vessels among the extravascular primo vessels are connected with the superficial primo nodes, while the profund primo vessels link together the intravascular primo vessels, the profund primo nodes, and organs.

3. Primo fluid circulates in the PVS.

This has been substantiated by the method of dye injection into the primo node and the primo vessel and by the use of radioactive tracers.

The speed of its circulation is slower than that of the blood, and is much slower in the extravascular primo vessel.

Circulation in the intravascular primo vessel is considered to be maintained by the heart beat as is the case with the blood and lymph circulation. In other words, the circulation of the primo fluid is, it is considered, caused by the differences of pressure created around it, since the primo vessel lies in the blood current.

It is therefore established that the primo fluid inside the primo vessel flows in one direction, in the same direction as the blood circulation.

The contractile action of the smooth muscles of the outer layer of the primo node is believed to play a definite role in the circulation of the primo fluid in the system of extravascular primo vessels.

The Kim Se Wook phenomenon (Phenomenon Kim Se Wook) to be observed when a needle is applied to a primo node shows the peculiar movement of the primo node.

4. The primo node has unique bioelectrical activity.

A series of similar changes of electric potential are observed in the primo node even when various electrodes and induction systems are applied to it. These changes of electric potential are connected with the action of the living body, particularly with the action of the PVS.

The electrogram of PVS directly induced from the primo node is different from the various electric changes so far induced from the skin.

It is presumed that “→” and “└” waves on the electrogram of PVS are directly connected with the action of the muscle layer of the primo node and “┐” wave with the secretory action of the cells of the primo node.

The effect of a stimulus given to a primo node is conveyed to the next primo nodes through the same primo vessel.

It is confirmed through various functional experiments that the electrogram of PVS also reflects the general functioning of the organism.

5. A large quantity of nucleic acids, DNA in particular, is contained in the primo node and primo vessel.

DNA in the primo vessel exists in a peculiar way, outside the nucleus in the homogeneous primo fluid.

This is established not only by the results of biochemical experiments but also by Feulgen reaction and other histochemical methods and by the luminescent microscopic examination.

In view of this, we consider that the action of the PVS is closely connected with nucleic acids.

And the specific form of the existence of nucleic acids in the PVS also requires the study of the functions and metabolism of nucleic acids from a new viewpoint.

Our new research achievements made public, we believe, have made a certain contribution to the comprehensive elucidation of the PVS, raised a series of important questions of principle in the field of modern biology and medicine, and opened up a new vista in the field.

Publishing the results of our researches today, we extend our heartfelt gratitude with deep emotion to the Central Committee of the Workers' Party of Korea and to Comrade Kim Il Sung, our respected and beloved leader, who have always directed profound solicitude and concern to our scientific research work.

We would also like to express our deep thanks to many scientists and friends at home and abroad who have actively supported and encouraged us in our research work.

The Kyungrak Research Institute
Pyongyang, Korea
November 30, 1963

3 The Kyungrak System (Primo Vascular System): *J Jo Sun Med* 1965 June 5;108:1-38

3.1 Conclusion

1. The meridians have several structures.
 - (a) All structures are commonly composed of primo vessels and primo nodes. All the primo nodes are connected by primo vessels. A primo vessel is a bundle of dozens of subducts.

- (i) The Bonghan subducts (primo lumens) are made of thin endotheliocytes with rod-shape nuclei, smooth muscle cells, and adventitia with fine argyrophilic fibers. The space between the primo lumens is filled with a fibrous structure and amorphous substances. Groups of a dozen or so subducts are tightened by the surrounding membrane. The primo lumen contains basophilic corpuscles and small nuclei-shaped structures.
 - (ii) The primo nodes are constructed basically by extensions, divisions, and anastomosis of the primo vessels. The structure of the primo nodes is based on the adventitia of the primo lumen and the network substances between the primo lumens.
- (b) The structures for the meridians are as follows.
- (i) Structures for interior primo vessels.
These structures are composed of the vessels and nodes, and are systematically distributed inside the blood vessels, lymphatic vessels, and the heart. The interior primo vessels are very fragile with thin adventitia and an interstitial substance. The interior primo nodes have similar structures with those of hematosis organs. The networks contain cells affiliated with the bone marrow and the lymphatic system. They also gather similar cells with those of a series of real organs.
 - (ii) Structures for interior–exterior primo vessels.
These are composed of vessels and nodes separated from the surrounding organs. They are extended regardless of the morphological constitution of the blood vessels and the nervous system. The interstitial substance and adventitia of interior–exterior primo vessels are more developed than those of the interior primo vessels. Inside the interior–exterior primo vessels, there are basophilic structures as well as bright-cell traits.
 - (iii) Structures for exterior primo vessels.
These are composed of ducts and corpuscles along the blood vessels and nervous system. They are covered by a thick membrane of connective tissues. There are many chrome-affinitive granules.
 - (iv) Structures for neural primo vessels.
These are composed of ducts and corpuscles floating in the cerebrospinal fluid of the central nervous system. The branches are distributed in the peripheral nervous system as well as the central nervous system.
 - (v) Structures in the organs for the meridians.
There are also ducts and corpuscles inside the organs connected from the interior, exterior, and neural primo vessels. Every duct in an organ is combined into a terminal primo vessel with which all the cell nuclei in the organ are connected. Fine primo lumens are divided and connected with every cell in the tissue. All the structures for the meridians are interconnected: the interior primo vessels are connected through the blood vessel walls to the exterior primo nodes, which are again