

Chapter 2

The TCM Ambit

2.1 The Evolution of Traditional Chinese Medicine

As noted in Chap. 1, the use of Traditional Chinese Medicine (TCM) has been around for more than 3,000 years. In its early period, due to difficulties of exchanging medical knowledge and clinical experience, TCM was practiced in various forms often dictated by different geographical and environmental conditions. With the rise of the Qin Dynasty that united China into a single empire with a standard writing system, the ability to exchange knowledge was greatly facilitated. This led to the first successful *Yellow Emperor's Canon of Internal Medicine (Huang Di Nei Jing)*, which remains an important TCM reference till today. This Canon comprises medical knowledge and clinical experience within the Qin territory.

As time passed, recorded medical and clinical information has been gradually refined, supported by both the civilian and governmental effort, and eventually constitutes more than 5,000 medical works. Useful herbal ingredients, which include plant parts, minerals and animal matter, have also been incorporated into the conceptual TCM pharmacopoeia.

Whilst earlier TCM practitioners were usually conversant with the broad combination of many areas of professional knowledge, TCM practitioners required more specialization in a specific area. This increase in specialization meant reduction in the knowledge of the areas. Modern TCM training and clinical practice also include incorporated techniques from Western medicine, including techniques such as use of X-rays, syringe-based injection and laboratory tests. It is a professional requirement that a TCM practitioner should have knowledge of nutrition to help patients recover from illnesses quicker and better. In TCM drug administration the base concept is that the continuum of food material can be divided into two basic categories: curative and health restoring. Yet, it is common that a health-restoring ingredient may become a prescribe-able main curative herb (e.g. Ren shen/Panax ginseng).

TCM (Traditional Chinese Medicine) as we know it today includes several Canons as its foundation, including:

1. *The Yellow Emperor's Canon of Internal Medicine (Huang Di Nei Jing)*, which was formulated in the eighth century BC (circa 722 BC), is the earliest treatise in the field. It is still revered as the ultimate medical reference by many TCM practitioners. The *Nei Jing* is rich in its contents and includes human body anatomy, physiology, acupuncture, blood circulation and its relationship to breathing and heart/pulse rate.
2. *Shen Nong's Canon on Materia Medica (Shen Nong Ben Cao Jing)*, which was compiled by the Han Emperor's decree in the 1st century AD. This contains more than 800 commonly used herbs for medical treatment during that period.

The *Compendium of Materia Medica (Ben Cao Gang Mu)*, which was compiled by a reputable TCM practitioner in the 16th century, Li Shizhen. This records the usage of almost 2,000 herbal ingredients. It provides a much stronger pharmacological foundation than the *Shen Nong's Canon*, and it is still strongly adhered to in today's TCM practice. Many herbal ingredients and their clinical efficacy are increasingly included in the Western medicine pharmacopoeia. The well-known example is *Artemisia (Qinghao)*, which is remarkably effective for treating malaria. In fact, in the People's Republic of China (PRC) many hospitals are "mixed" in nature, practising both TCM and Western medicine at the same time. Which expertise plays the lead role and is complemented by the other depends on the illness and the physical condition of the patient at the time. It is not uncommon that the medical team formed to treat a patient is made up of both TCM and Western medicine practitioners. This approach helps speed up the inclusion of herbal ingredients in the domain of Western pharmacopoeia. It is interesting to note that food and medicine are in the same continuum within the *Compendium*. This explains why TCM practitioners always try to maximize medicinal treatment by complementing it with strong suggestions of proper nutrition.

In the Ming (1368–1644) and Qing (1644–1840) Dynasties, TCM had advanced tremendously because of support from the government, especially in the areas of anatomy, etiology of disease, treating communicable illnesses and methodical applications of various herbal ingredients. As a result, a wide range of principles for diagnosis, therapies and principles for dispensing drugs were formalized to treat ailments in an easier and more standard way. This is well reflected by clinical TCM practice today.

2.2 Underlying Theory

The anatomy of the human body in the TCM view differs from the conventional biological concept. The main difference is the inclusion of the conceptual network of meridians and collaterals. The meridians associate with the corresponding organs such as the liver and the spleen. This organs-meridians association is verifiable from

the point of view of acupuncture. The explanation of health maintenance is also different from the conventional physiology approach. In TCM, health is maintained if the Yin and the Yang in the body are balanced [Maciocia05]. The main task for the physician to treat a patient is to get rid of the excess (Yin or Yang) and supplement the deficiencies (Yin or Yang). If the human body is correctly balanced by Yin (material base) and Yang (metabolism), then the equilibrium brings about and maintains health. Therefore, the most important concept in TCM is to maintain this equilibrium by eliminating excesses and supplementing deficiencies. The metabolism consumes the material and converts it into the necessary vital energy flow (Qi) in the body, and we need proper nutrition to support the material base (Yin). TCM differs from Western medicine by stressing that every vital organ (e.g. liver) in our body has its own unique Qi characteristic. There are 12 conceptual organs all together, namely, (1) the solid Yin viscera: heart, liver, spleen, lung, kidney and “pericardium” (i.e. the layer of membranous tissue surrounding the heart), and (2) the hollow Yang bowels: small intestine, gall bladder, stomach, large intestine, urinary bladder (including the “female capsule”—i.e. reproductive system), and “triple warmers/burners” (i.e. the three body cavities, namely, (a) above the waist, (b) at the diaphragm and umbilicus, and (c) below the umbilicus). Every organ has its specific channel (technically called the Jing or meridian) for its Qi to flow through, and that is why our body has 12 organ-based Qi channels or meridians. The pattern of the Qi flow reflects the health condition of the organ. The Qi in the meridians interact to maintain our health or metabolic equilibrium via the smaller Qi ducts (technically called the Lok or collaterals). The 12 “organic” Qi channels, the numerous collaterals, and the two main Qi “highways” make up the complete Qi network of the body. Eventually, the Qi from the 12 meridians drains into the two main Qi “highways” to complete their flow cycles. The two main “highways” are the Ren meridian in the front of the main body and the Du meridian at the back. All the Yin Qi channels drain into the Ren meridian, whereas all the Yang ones drain into the Du meridian. The concept of Qi flow in the 14 meridians altogether provides the foundation for balancing the body’s Yin and Yang to achieve health, and physiological and spiritual equilibrium. The spiritual part is a very important parameter of good health because it is achieved only when the body’s Yin and Yang are balanced. The significance of this parameter is enshrined as a formal TCM axiom (formalism), namely, “If the Yin is sufficient and the Yang dynamics are stable, then a person will attain spiritual calmness”. In the TCM domain consistent spiritual calmness is the gateway to longevity. If there is no blockage in the Qi flow of any kind, a person will be in the healthy state. To get rid of any Qi blockage, appropriate measure(s) such as herbal concoctions and acupuncture can be administered in a controlled and progressive manner. For this reason all the herbal ingredients are classified by two parameters, namely, their associations with the particular meridians/organs and their temperaments. The temperament includes heating, cooling, warming, “neutral” as far as the effect on the ambient body temperature is concerned; rising—bringing the curative drug effect upward to the body surface; sinking—bringing the curative drug effect

downward deep inside the body; and conducting—bringing the curative drug effect to the desired spot, channel and organ. The details and meanings of herbal temperaments are formally documented in TCM Canons, and they will be explained later in this chapter.

2.3 TCM Diagnosis and Treatment

The process of diagnosis is based on the following formalisms, which have three broad categories, namely:

- (a) The four steps:
 - (i) Inspection—looking for apparent signs (e.g. acne/sores/ulceration/eczema and tongue—its colour and texture), as well as usual visual conditions along the Qi meridians.
 - (ii) Listening—searching for unusual sound uncontrollably made by the body part(s) (e.g. a hissing sound while the patient is breathing may indicate pneumonia or asthma).
 - (iii) Questioning—asking questions about how the patient feels, his/her past sickness/treatment history, habits and dietary preferences (e.g. constipation? sudden surge/waves of fever and/or cold? insomnia? phlegm/sputum colour (e.g. yellow phlegm indicates possible inflammation in the lung)).
 - (iv) Taking the patient's pulse based on the 8 principles and 4 basic pulsation guidelines—pulse waveforms have very specific and significant diagnostic meanings.
- (b) The 8 principles for illness type identification:
 - (i) Cold/heat types—these two principles differentiate the nature of the sickness being diagnosed; for example, anything of the anaemic nature is the cold type (and the treatment is to heat the body up) and any inflammation is the heat type (and the treatment is to “cool” the body, reducing the inflammation).
 - (ii) Surface/internal types—the status of the sickness is surface because it has not impeded the core of the organ function (e.g. coughing/fever due to a flu is “surface” but pneumonia is “internal” because part(s) of the lung issue might have died).
 - (iii) Deficient/excess types—the sickness is caused by Yin or Yang deficiency (e.g. blood loss) or excesses (e.g. indigestion due to gluttony); and Yin/Yang types—if it is caused by material-based problems, then it is the Yin type (e.g. loss of blood), and if is caused by metabolic malfunctions/blockages (e.g. gall/kidney stones), then it is the Yang type of problem.

- (c) The 4 basic pulsation axioms: The four axiomatic guidelines, which help the physician to confirm the correctness in the interpretations of the 8 principles mentioned above, are as follows:
- (i) Floating—the pulse that can be felt on the standard/dedicated wrist-based positions is shallowly close to the skin surface; this usually indicates excessive heat rising from the body/organ(s), for dissipation purposes.
 - (ii) Deep—the pulse can only be felt by pressing hard on the standard wrist-based points; this usually indicates slow/weak metabolism.
 - (iii) Slow—slow pulsation means weak metabolism and Qi blockage.
 - (iv) Fast—more serious inflammation normally produces rapid faster pulses of various forms. In fact, the 4 basic pulsation guidelines can be further differentiated during the pulse-taking process by recognizing the different additional tell-tale signs (e.g. a fast pulse in the shape of a sine wave (called “pearl-like” could mean lung inflammation for a man/woman, but further differentiation is needed to ensure it is not pregnancy (which typically manifests in the form of “pearl-like” pulses) for a woman).

The following illustrative medical case would help categorize the above diagnosis and herbal classification process differentiating the perspectives. In this case the symptoms obtained by the 4 axiomatic guidelines strongly indicate pneumonia at the early stage:

- (a) Inspection—the patient coughs violently and needs to move his/her shoulder upward (i.e. to move the rib cage upward) to assist the coughing act. (It is worthwhile to mention here that modern TCM practice also inspects the X-ray images and other laboratory tests such as sputum analysis).
- (b) Listening—the patient breathes with a hissing sound (one needs proper training to detect this phenomenon).
- (c) Questioning—the answers from the patient reveal that the sputum is yellow and fever occurs in the late afternoon.
- (d) Pulse—very fast “pearl-like” fast pulse that can be felt from the wrist surface.

The strong likelihood of pneumonia is further confirmed by applying the 8 axiomatic principles based on the diagnosis result:

- (a) Heat type—inflammation in the lung.
- (b) Internal type—part of the lung tissue could be severely injured.
- (c) Deficient type—the severe injury of the lung tissue means damage (i.e. “loss”) of the organ’s material base causing Yin/Yang imbalance leading to inflammation and spurious heat (i.e. resultant surge of the Yang dynamics due to deficient Yin).
- (d) Yin type—it is caused by material-based problems.

Different measures can be prescribed alone or in a combined manner (e.g. herbal concoctions and/or acupuncture) to treat the above case. The herbs in the concoction should ideally meet the following four aims: (i) the *principal* herb(s) should stop the lung inflammation; (ii) the *adjuvant* herb(s) should help repair the damaged lung

tissue and neutralize the undesirable effect from the principal herb(s); (iii) the **auxiliary** herb(s) helps catalyze, correct and accelerate the curative effects of the principal and adjuvant herbs and may also incite the sinking or rising of these effects; and (iv) the **conductant** (also known as **messenger**) herbs bring the overall curative effect to the sick organ and its Qi channel.

The prescription for treating the aforementioned pneumonia case example may consist of the following ingredients among other possible choices because it depends on the physician's experience and preference:

- (a) The **principal** herbs: "Yu Xing Cao" (*Herba Houptuyniae*) and "Huang Qin" (*Radix Scutellariae*) to stop lung inflammation and alleviate coughing.
- (b) The **adjuvant** herbs: "Bai Ji" (*Rhizoma Bletillae*) and "Jie Geng" (*Radix Platycodi*) to help heal the lung tissue and catalyze the curative effective of the principal herbs.
- (c) The **auxiliary** herb: "Gan Cao" (*Radix Glycyrrhizae*) to neutralize those possible undesirable effects from the principal and adjuvant herbs.
- (d) The **conductant** herb: "Ge Gen" (*Radix Puerariae*) to bring the overall curative effect to the Lung meridian; it also brings the heat due to the lung inflammation (i.e. the "rising effect") to the body surface so that it can be dissipated quickly.

In the above discussion, the pneumonia case helps demonstrate how diagnosis and treatment can be achieved by applying the time-honoured axiomatic guidelines and axiomatic principles, which are clearly documented as formalisms in the relevant treatises and Canons. With this information in mind, we can proceed easily to explain the conceptual framework of how herbs are classified in general.

2.4 Herbal Pharmacology

The term herbs in Traditional Chinese Medicine (TCM) should not be taken literally, because, other than plant parts, they also include other material such as minerals, insects, reptiles and animal matter. From the pharmacology TCM viewpoint, herbs can be classified in different ways into different systems according to the set of chosen keys as set out below:

- (a) Its association to the Qi channel(s) of the organ(s) as the key: Any herb may associate with one or many Qi channels or organs. For example, "Bai Ji" (*Rhizoma Bletillae*) associates with three organs (and thus three channels), namely, lung, liver, and stomach. Its medicinal effect on each organ may differ; for example, it may be used as a principal herb for the stomach but an adjuvant for the lung. Since the meridians are used as the keys for herbal classifications, *Rhizoma Bletillae* appears repeatedly in each of the three organs/channels in the final herbal classification system, namely, for the lung, liver and stomach Qi channels or meridians.

- (b) Its temperaments as the key: A particular herb may possess one or several of the following properties: heating, cooling, warming, ambient, rising and sinking. For example, “Huang Qin” (*Radix Scutellariae*) is both cooling (i.e. stopping inflammation) and rising (i.e. bringing the heat due to inflammation to the body surface to be dissipated quickly).
- (c) Its association with a particular illness: Since a particular herb may be used to treat different illnesses, acting as the principal, adjuvant, auxiliary, or conductant role, we can classify herbs using an illness name or type as the key. This can be achieved by examining the different roles of the same herb when prescribed in previous relevant clinical cases.

If we employ an herbal classification scheme with respect to the set of chosen keywords words (e.g. the 12 Qi channels or organ meridians) a communal ontology [JWong09c], then it is the knowledge base or lexicon by consensus for the community. With this ontology, the communal knowledge can be passed on effectively and unambiguously to the subsequent generations. The standard or consensus-certified vocabulary in the lexicon can be changed only by another new consensus certification in a manual, laborious and communal manner. In TCM there are many communal ontological schemes that exist on top of the knowledge included in the Canons already. The communal ontologies are normally created to suit a particular aim, for example, for industrial standardization, for quick reference of the consultative type, and for enterprise operations. In the case of TCM, communal ontologies are usually subsets extracted from the total/global TCM knowledge embedded in the Canons. A useful industrial/enterprise TCM ontology is well exemplified by PuraPharm’s TCM ontological core (or simply onto-core) for computer-aided, web-based clinical practice [JWong09a]. From the proprietary master TCM onto-core, which contains only clinical facts, the PuraPharm Company customizes different computer-aided clinical TCM systems specified by its customers. This is achieved by using a fast-prototyping process called the *WD²UHI* (*Web-based Data Mining and Discovery of Useful Herbal Ingredients*) platform [JWong09d]. In Hong Kong many vehicle-based mobile clinics, which are interconnected over the web, are manned by a clinical TCM system customized by PuraPharm (e.g. the famous local YOT (Yan Oi Tong) mobile clinics that treat thousands of patients daily).

2.5 Computer-Aided TCM Takes Various Forms

The TCM domain is wide, and in terms of applications it is associated with our daily lives in the following areas:

- (a) Curative: This normally involves the process and treatment by the physician. The physician prescribes the treatment of the diagnosed illness according to the TCM formalisms. The aim is to balance the Yin and Yang [Maciocia05].
- (b) Health restoring: In TCM, our food material is also medicine because the food continuum can be divided basically into two categories: curative and dietary.

The curative category usually has potent medicinal properties with specific purposes, for example “Ge Gen” (*Radix Puerariae*) is an efficacious conductant for the lung Qi channel. Yet, it is also a common dietary tuber for making soups for family consumption. When a person is not sick, “Ge Gen” offers dietary advantages: (i) it provides carbohydrates for the body energy, and (ii) it facilitates the body’s sweating process to make our body cool in hot weather. In this case “Ge Gen” is health restoring. It is the same for the popular herb “Ren Shen” (*Panax ginseng*), which is the principal herb for many curative prescriptions. But, it is also a common herb for making tea and soup for boosting the body’s immune system; it is considered a preventive food material.

Since TCM is associated closely with our daily life and the continuum of food material can be curative and health restoring at the same time, its origin is folk medicine. The transmission of folk medicine at the beginning was from mouth to mouth and from one generation to another. It is customary that a young person in a Chinese village would consult the elders on what to do in order to get well. Therefore, consultation in TCM is not restricted to only the physician but also includes the elders who know the folklore knowledge.

From the above discussion it is clear that computer-aided TCM may take various forms including the following:

- (a) Curative: It helps the physician in terms of patients’ histories and decision making in the diagnosis/treatment process. A basic curative computer-aided system usually has the following modules: (i) the man/machine interface, (ii) database of patient cases treated by the physician, (iii) accounting (managing the different fees and charges) and (iv) form printing (e.g. prescription forms, and report to the government in case of communicable illnesses)
- (b) Consultative: There are different types of consultative systems including the following:
 - (i) Type 1—for common/lay use: It lists/explains herbal matters for health restoring, and usually this can be a standalone or supported by different websites that provide the relevant information. If it is web-based, then it is already a form of telemedicine (a minor one) according to the United Nation’s definitive concept.
 - (ii) Type 2—for common/lay use: It assists anyone to find patent drugs and lists the name of the manufacturers, efficacy statistics, reported side effects and the pharmacies where they can be bought. This type of system is particularly useful for newcomers (e.g. tourists) to a city in emergency cases. Similarly there are also systems that list the medical practitioners, clinics and hospitals in the region so that people can get help. If these systems are web-based, they have already taken the form of telemedicine, however primitive.
 - (iii) Type 3—for TCM education: This type of system usually has an architecture of three layers: the first/top layer for the user to input the query; the second/middle layer is the semantic net that interprets/executes the

query; the third/bottom layer, which is the database from which the semantic net fetches the required data and returns it to the user as the response to the input query. Again, this type of system can be standalone or web-based.

Within the concept of telemedicine [Lacroix99] the different systems above can be standalone or web-based. In some cases the standalones are interconnected via different networks to achieve the required speed, security, resolution and privacy. In a broad sense, any medical systems that are interconnected via a network indicate their use of telemedicine.

2.6 Contemporary TCM Telemedicine

Contemporary TCM telemedicine is usually ontology-based [Rifaieh06] because the ontological approach allows unambiguous communication and precise answers. It makes use of the idea of the semantic web [W3Ca, W3Cb] so that useful, current scientific TCM discoveries can be data-mined from/via the web. This on-line web mining capability is the backbone of the evolutionary concept of living ontology [JWong08a]. It is reasonable that contemporary TCM Telemedicine should possess at least some of the following characteristics:

- (a) Ontology-based: There is always a master ontology from which modular sub-ontologies [JWong09c] can be isolated accurately. In this respect the EOD-
ISD type of paradigms may be used.
- (b) Global: Since modern telemedicine systems operate on the Internet/web, it is part of a global net knowingly or unknowingly.
- (c) Information sharing: The medical practitioner sitting in front of its system (e.g. D/P system) can solicit and import/export information anytime and anywhere around the world.
- (d) On-line useful data collection: Using the PuraPharm's pervasive MC-based telemedicine D/P system in Fig. 1.5 as an example, the D/P statistics (e.g. the types of illnesses, the amount of the prescribed herbal ingredients and the likelihood of having communicable illnesses) can be obtained on-line and sent to management and the appropriate authority. With this information the herbs provider management can proactively formulate the ingredients' production plan, and the authority would have more time to plan the preventive measures.
- (e) Education: In the past, the medical practitioners had to go to the field to carry out the medical tasks such as diagnosis and prescriptions for treatment in order to get experience. With a telemedicine system such as the PuraPharm D/P system, all the cases treated by different physicians using the same D/P terminal will be stored in a repertoire of personal experiences. This is shown in Fig. 1.8 as the "Experience Window". Normally, only the personal experience of the registered physician who is operating the terminal at the time can be accessed. For educational purposes, all the personal field experience of all the

physicians can be collated into a single file. Then, a trainee can diagnose for the set of artificially input symptoms and then prescribe the corresponding treatment. After that the trainee can compare his/her D/P conclusion with those collated cases in the Experience Window. In the process, the trainee can effectively gain from past experiences gradually.

Living ontology: The information on the web is a treasure trove, and this inspires active research in the area of the semantic web [Taniar06, W3Ca, W3Cb]. Every day there are many new scientific TCM findings reported on the web in various forms and websites. If a telemedicine system can send out data miners to collect these new findings and temporarily append them to the local consensus-certified onto-core in an on-line manner, then several advantages become apparent. The first advantage is that the physician can use these new findings as references in their D/P decisions. The second advantage is that this new and raw data can be part of the information to be considered in the next consensus certification of the update/migration of the master onto-core [JWong09d].

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