Editorial

Black Box Theory and Diagnostic System of Traditional Chinese Veterinary Medicine

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History of Black Box

The initial idea of Black Box can be traced to two-port networks (quadripoles) that were created by a German mathematician, Franz Breisig, in 1921. In 1941, twenty years later, Wilhelm Cauer, another German mathematician and scientist, applied this idea in electronic circuit theory. Norbert Wiener, an American mathematician and philosopher, defined a Black Box to be an unknown system that was to be identified using the techniques of system identification in 1948. Since then, the Black Box theory has been widely applied to philosophy and science.

What is the Black Box?

A Black Box is a system or object which is purely external or phenomenological and its internal constitution and structure is unknown or irrelevant to being opened for inspection. The opposite of a Black Box is a White Box, that is a system where the internal constitution and structure can be viewed. A White Box is also referred to as a clear box, transparent box, or glass box.

As illustrated in Figure 1, a White Box is transparent, like glass, as we can see all that is inside the box. On the contrary, we cannot see what is inside the Black Box. How the Black Box functions internally, however, can be tested and defined in terms of its “stimuli inputs” and “output reactions” (Figure 2). In other words, an observer or investigator is able to figure out how the Black Box functions internally by the relationship between the exterior appearance of something to its characteristics and behavior within (interior/inner).

For example, the school of behaviorism sees the human mind/brain as a Black Box in psychology. Since the brain cannot be opened to be examined, a psychologist can design a series of questions for a patient (input), and the responses from a patient (output) are analyzed to decipher the type of behavior issues present. Another example is that the earth can be treated as a Black Box when undertaking oil exploration. After exploration tests are conducted on the surface of the Earth (input), the signals from the surface (output) are analyzed to determine potential oil field locations.

White Box and Medicine

With a White Box, we can see what is inside the box (Figure 1). All modern diagnostic devices including MRI, CT scan, radiographs and ultrasound help clinicians visualize the interior of the body and give an accurate diagnosis (bony changes, fracture, neoplasia and other pathologic changes); thus, they are the White Box approach. Another example is exploratory laparotomy. The abdominal exploratory surgery is often used to investigate an inconclusive mass or other gastrointestinal disease in veterinary medicine. After the abdomen is surgically opened, a veterinarian is able to view pathological changes (such as masses), and a biopsy sample is collected when

Figure 1: White vs Black Boxes

Figure 2: How the Black Box works
necessary for further diagnosis.

**The Traditional Chinese Veterinary Medicine (TCVM) Diagnostic System**

When TCVM diagnosis was developed several thousand years ago, ancient healers did not have modern diagnostic tools such as laboratory tests, radiography, ultrasound, scintigraphy and magnetic resonance imaging (MRI). Instead, the ancient medical practitioners could only rely on their senses to gather information about a patient’s condition. The practitioners visually evaluated a patient’s behavior and body appearance to identify abnormalities. They used their hands to feel the pulse and palpate the body. Their senses of hearing and smell allowed them to identify abnormal noises or odors coming from the patient. Over generations, TCVM practitioners established *Si-zhen* (“four diagnostic methods”) which provided a systematic method for collecting clinical data (external information from the patient) in order to make the correct diagnosis (Table 1). The theoretical principle behind *Si-zhen* is that changes occurring within the Interior of the body will be evident on the Exterior due to the connections among the organs. Thus, a practitioner can examine the Exterior signs to understand the condition of the body’s Interior *Zang-Fu* organs. This is well documented as “To know the inside by examining the outside” in the ancient traditional Chinese medical classical text *Huang Di Nei Jing* (Yellow Emperor’s Classic of Medicine). For example, redness and swelling of the eyes may indicate a Liver Heat Pattern because eyes are associated with the Liver and redness and swelling correspond with Heat or Fire. The characteristics of Heat or Fire tend to ascend, thus their pathological damage is not only in the Liver, but also in the eyes that are the Exterior portion of the Liver System. TCVM practitioners, therefore, can predict that the condition is Liver Heat or Fire (interior) when they see redness and swellings of the eyes (exterior).

Other examples of exterior observation revealing internal TCVM Patterns include gingival bleeding/ ulceration with Stomach Fire, tongue ulcers with Heart Fire, nasal discharge with Lung disorders, diarrhea with Spleen Qi Deficiency and congenital disease with Jing Deficiency. In the first 2 exterior observations, the redness and swelling associated with gingival bleeding or ulceration and tongue ulcers corresponds to Heat or Fire. Since the Stomach Channel runs through the gingiva and the Heart opens into the tongue, the interior TCVM Patterns associated with these external clinical signs is Stomach Fire and Heart Fire, respectively. The nose is the opening for the Lung, therefore, nasal discharge/congestion (exterior) is associated with Lung disorders (interior). A watery, loose stool (exterior) is a diagnostic sign for Spleen Qi Deficiency (interior) as the primary function (Qi) of the Spleen is to digest/absorb food and move fluid. Deficient Spleen Qi fails to digest/absorb food and move fluid, leading to excessive dampness and watery diarrhea. Finally, a young white kitten born deaf, suggests a Kidney problem (hearing functions are associated with the Kidney), specifically a Kidney Jing Deficiency.

**TCVM Etiology**

According to TCVM, the body normally exists in a

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**Table 1: The Four Diagnostic Methods (*Si-Zhen*)**

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<tr>
<th><strong>Si-zhen</strong></th>
<th><strong>TCVM Examination</strong></th>
<th><strong>Western Medicine Counterpart</strong></th>
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| **Inspection Wang** | • Examine the tongue characteristics and color patterns  
• Observe the Shen (the Mind-state)  
• Observe the general body condition  
• Evaluate the quality and luster of the hair and skin | Observation |
| **Hearing Smelling Wen** | • Listen to the voice quality (weak, muffled, strong and/or robust)  
• Listen to breathing  
• Auscultate heart and lungs  
• Note odors from the body, breath, ears | Auscultation  
Olfaction |
| **Inquiring Wen** | • Question owner about medical history  
• Question owner about temperature-preferences, diet, personality, activity, clinical signs | Interrogation |
| **Palpation Qie** | • Feel the pulses  
• Palpate the Meridians  
• Palpate the back-Shu (association) points and front-Mu (Alarm) points for sensitivity  
• Palpate abdomen, lymph nodes, joints | Palpation |
state of equilibrium between the external environment and the Zang-Fu organs. To maintain this equilibrium, the body regularly readjusts itself to maintain normal functionality as the various external and internal forces fluctuate. Disease results when certain forces overwhelm the body’s capacity to adjust and disrupt the delicate balance. The factors which impair the body’s equilibrium and cause disease are called Pathogens or Xie Qi. The Xie Qi exists external to the body and includes allergens, seasonal or environmental changes and infectious organisms such as viruses, bacteria, and fungi. These etiologic factors invade the body through the skin, mouth, or nose and cause imbalance which results in disease.

Different pathogens produce different signs within the body, so a TCVM practitioner can diagnose the etiology by analyzing the clinical manifestations of a disease. This is known as “seeking the cause of a disease by differentiating clinical signs” or Shen Zheng Qiu Yin. In addition, the treatment principle depends upon the cause of the disease. This is otherwise known as “treatment according to the cause” or Shen Yin Shi Zhi. It is the TCVM practitioner’s role to recognize the exterior clinical signs resulting from a certain Pathogen and then administer a specific treatment to resist the previously diagnosed Pathogen. For example, the TCVM practitioner would recognize that a sick horse exhibiting alternate limb lameness is affected by pathogenic Wind and Damp and would apply a treatment that eliminates Wind and Damp.

TCVM diagnosis relies heavily on gathering information about clinical signs and then determining how they fit with known Pathogens, therefore, combining both conventional and traditional Chinese medical diagnostic principles can be advantageous for disease diagnosis.

Conventional Western diagnostic tests and physical exam complement the traditional Chinese history and physical exam. A Western diagnosis can become part of the TCVM diagnosis, and a TCVM diagnosis can further clarify a Western diagnosis. For example, radiographs are an invaluable tool to visualize the joints and may provide a Western diagnosis of degenerative joint disease or arthritis. Chinese medicine, however, can further define which type of arthritis based upon the patient’s collective clinical signs.

The TCVM Diagnostic System and Black Box

“To know the inside by examining the outside” is the fundamental principle of Traditional Chinese Veterinary Medicine (TCVM) diagnostics. Thus, the animal body is treated as a Black Box. A TCVM practitioner relies on a patient’s external information (clinical signs, tongue and pulse) to make a diagnosis and predict how the internal organs function or malfunction. This diagnostic system is also called Bian Zheng involving identifying pertinent clinical signs (Bian) and determining the Pattern of illness (Zheng).

TCVM is the Black Box approach. Initially, a Black Box was used as a computing device that returned an output after giving an input (Figure 2). In TCVM, all of the pathogenic factors (allergen, virus, bacteria and fungus) are the input (stimulus). Zheng Qi (the collective anti-pathogenic power) of the animal body (Black Box) will respond to the invasion of Xie Qi. All of the output data (tongue, pulse and clinical signs) from a patient can be analyzed and a final TCVM Pattern can be differentiated.

![Figure 3: The Black Box approach of the TCVM Diagnosis](image-url)
and determined (Figure 3).

**Clinical Application of the TCVM as a Black Box**

Identifying relevant clinical signs is a common task in Western medical diagnosis; however, the concept of Zheng (Pattern of disease) is a much more formalized system in TCVM. In TCVM, the diagnosis is the TCVM disease Pattern (Zheng). A particular TCVM diagnosis is assigned to specific combinations of clinical signs resulting from particular imbalances within the patient.

A Western medical disease diagnosis analyzes significant clinical signs, laboratory tests and diagnostic images to find the underlying cause. Although Western practitioners do acknowledge that some diseases can produce stereotypical physical manifestations, such as Cushing’s disease in dogs; these disease patterns are less specific than in TCVM. The same Western medical diagnosis may correspond to different TCVM Patterns. Consider the following two examples:

**Case Example One**: A Western medical practitioner diagnosed two horses with bloody diarrhea as having *Salmonella* colitis because fecal cultures were positive for *Salmonella* species. The first horse was a two-year-old Thoroughbred filly who presented with profuse hemorrhagic diarrhea which had begun three days prior to presentation. She had a red tongue and rapid pulse. The second horse was an eighteen-year-old Thoroughbred mare who presented with a twenty-one day history of bloody diarrhea. The mare had a pale tongue and weak pulse. Although both horses were diagnosed as having *Salmonella* colitis, their TCVM diagnoses differed; the first horse had an Excess Heat Pattern because of the red tongue, rapid pulse, young age and acute onset, while the second horse had Spleen Qi Deficiency based upon her pale tongue, weak pulse, old age and chronic diarrhea.

**Case Example Two**: A Western medical practitioner used allergy testing to diagnose two dogs with atopic dermatitis. One dog was a friendly and high energy two-year-old castrated male Labrador retriever with a Fire personality. He presented with constant pruritus and showed Heat signs (red tongue, a bounding pulse and cool-seeking behaviors) without Deficiency signs (weakness). The second atopic dog was a thirteen-year-old spayed female bichon frise that has chronic allergies (weakness). The second horse had Spleen Qi Deficiency based upon her pale tongue, weak pulse, old age and chronic diarrhea.

Thus, for an effective Chinese medical treatment, the TCVM practitioner must accurately identify the signs indicating the kind of imbalance and not rely solely on the Western diagnosis.

**CONCLUSION**

The TCVM approach is like the Black Box. External information (clinical signs) displayed by patients is used to diagnose the correct TCVM Pattern which enables the veterinarian to select an appropriate treatment correctly matched to the pattern. It is a very useful approach, especially in clinical cases when a Western diagnosis is not available or is unable to pinpoint the etiology of a disease.

**REFERENCES**

7. Chapter 47 of *Ling Shu* (Miraculous Pivot), *Huang Di Nei Jing* (Yellow Emperor’s Classic of Medicine), (In Chinese, originally published in 475-221 BC).