DRAFT

The Central Status of the Dantian

by C.P.Ong, Ph.D.

(An excerpt of this paper was presented at the Taiji Symposium in honor of Grandmaster Chen Xiaowang's 70th Birthday celebration on Oct 2, 2015, Chenjiagou.)

Summary

The concept of the central status of the dantian (*dantian wei hexin* 丹田为核心) captures in the most essential form, the art of Taijiquan, from the pragmatism of training to the efficacy of its kungfu application. Chen Xiaowang's teachings are encapsulated in the concept, which places as paramount the establishment of the centrality of the dantian (*dantian hexin de xing cheng* 以丹田核心的形成).

The principle of dantian centrality infuses the body with inner balance, which encompasses the full comprehensiveness of bipedal balance, and where motion is regulated to conform with the yin-yang theory. Implicit in body motion generated under the imprimatur of Taiji theory is that it is of the grandest Taiji order—unsurpassed in versatility, liveliness and kungfu utility. The principle's insight is that critical to bipedal functionality and mobility is balance. Without the maintenance of bipedal balance, all talk of Taijiquan's prowess is rendered vacuous.

The paper injects physics and physiology into the exposition of dantian centrality to give the Taijiquan concepts, including *neijin* (inner strength), the precision of biomechanics. It examines the force of *neijin*, and the mechanics of the *rou* ("softness") and *gang* ("hardness") of *jin* in the principle of using "softness" to overcome "hardness" (*yi rou ke gang*), which underlies all the wondrous martial skills of Taijiquan. The science in the study not only sheds more light in the esoteric Taiji concepts, but importantly, also provides the practitioner with more pragmatism in the training to help attain mastery.

"Dantian happy"

The intonation by Chen Xiaowang in his workshops still rings in my ears: "calm down, mind empty, body balanced, mind balanced, listening behind, qi sinking, dantian happy." The theme of "dantian happy" recurs throughout the course of his teachings, in practice and in writings. The plain ordinariness of the phrase, seemingly expressed light-heartedly, turns out to represent the core principle of the art of Taijiquan:[1]

Yi dantian wei hexin 以丹田为核心
Establish the central status of the dantian.

It can be said that the litany of exhortations in Taijiquan training:

- point the crown of the head up with no tension (*xu ling ding jin*),
- keep the body straight, centered, and not leaning (*li shen zhong zhen bu pian bu yi*),

- sink the shoulder and drop the elbow (*chen jian zhui zhou*),
- contain the chest and settle the waist (*han xiong ta yao*),
- bend the knees and open the kua (*qu xi kai kua*),
- relax the waist and round the crotch (*song yao yuan dang*), and so on,

is directed at *fangsong* for qi to sink to the dantian (*qi chen dantian*) to nurture the central status of the dantian. Indeed, the whole practice is about cultivating and maintaining the centrality of the dantian—infusing the principle in the body.

Imbued with the principle of dantian centrality, the body moves and responds with inner balance, and the wondrous skills of Taijiquan kungfu flow forth with ease. That is to say, all the "ten thousand" kungfu techniques find their basis in dantian centrality, exemplifying the principle of:

Wan fa gui yi.
Ten thousand techniques sourced to one principle.

Achieving the formation of the central status of the dantian—*dantian hexin de xing cheng* 以丹田核心的形成 represents the mastery of the art of Taijiquan.

We see the imperturbability of Chen Xiaowang's dantian centrality in display in his encounter with Longwu, a two-time Asia strongman champion and hailed the Asian Hercules. The strongman could move an eighteen-wheeler and nudge a car into a tight parallel parking spot between two cars, but he could not move the older and smaller Chen Xiaowang an inch, in an open challenge of three one-minute rounds. The master merely stood there, attending to his dantian centrality to keep intact his inner balance without fighting back, as the strongman pushed and shoved at him with all his might to no avail.[2]

What does dantian centrality mean in physics and physiology? The study will shed more light into the traditional Taiji theory and methodology, which will help guide one's training towards nurturing dantian centrality and thus mastery. First, we look at how dantian centrality relates to bipedal balance.

Inner balance

At the heart of dantian centrality is the concept of inner balance. A body may be in physical balance, but the dynamics of the underlying muscle actions is not the same. Clearly, a master's posture is not the same as that of a student, even though physically both are in balance. The master's posture is unmistakably more formidable—it exudes fluidity and solidity.

Let us review some postures and actions in common situations that demonstrate physical balance but are wanting in inner balance. A very telling incident is the common task of picking up a box. By habit, the hands reach out first for the box, and the body follows, bending forward. To keep the body from falling over, muscles are activated by

reflex to hold the leaning posture. In lifting the box, the body is pulled down by the box's weight, requiring more muscle power to maintain balance, and even more to lift it. No wonder, we see many a broken back in the exertion of picking up things. While the leaning postures are in physical balance, they suffer from inner balance. By bending at the knees, the body could maintain balance with less muscle activations, and could use the leg muscles to help lift the box. In the two sets of muscle activations, the second does the task with far less effort and danger to the back than the first, and points to a better inner balance.

In a medical checkup, the doctor puts a stethoscope on your chest, and asks you to take a deep breath. When you do so, the chest is heaved up and the abdomen is hollowed. The body becomes top heavy, and it topples easily with a gentle nudge. The body is in physical balance—the position of the center of mass remains the same as that of a posture at ease, which has a better inner balance. Bracing up the chest breaks the inner balance between the upper and lower body, thus weakening the support of the base. The practice exhortation of *hanxiong* (contain the chest), is to prevent this from happening, and keep more intact the connection between the upper and lower body.

Inner balance is often breached In common routine actions as we take balance for granted. For example, in the simple action of raising the arm high up to draw attention. the prime moving muscles at the shoulder—the deltoid and the pectoralis—dominate. While in physical balance, the dominating action of these muscles causes the ribcage to be raised, which breaks the inner balance. An opponent can take advantage of the breach to readily uproot the body and send it flying. Note that this action of excitement is the opposite of Taiji's deliberative slow motion.

From these considerations, we see that for any given action or posture, there is a multitude of muscles supporting it in varying levels of activation, with each composition resulting in a different internal quality of balance. What is an ideal composition of muscle activations corresponding to an action?

We may understand the multitudes of muscles involved in an action, but the input and output signals of muscle activations that correspond to an action are too complex to compute in real time. Even as the mathematical models of engineering science are giving us better solutions in human robotics, they cannot feed into the neural circuitries to produce the action.

This is where we find the ingenuity of Taijiquan, which provides practical answers outside of the exact solutions of engineering science. As it turns out, Taijiquan's solution is as elegant as it is simple—produce muscle activations, namely movements, that conform to the yin-yang principles. This metaphysical guidance may be alien to the musculo-skeletal framework, but as we shall see, the Taiji yin-yang approach in practice is quite functional and pragmatic.

Inner imbalance is defined as an imbalance of yin and yang. *Taiji balance* or *inner balance* is attained through the resolution of yin-yang imbalances—not too yin or too

yang. The solution does not seek the exact balance of yin and yang as in a balance scale, weighing in with so much of yin or so much of yang. Taiji's strategy is to stay in the middle ground between the imbalance errors of yin and yang, and to only keep on working to reduce the errors (*wucha* 误差) in the practice. As the margin of errors tapers, the practice path will gradually converge to inner balance. This exemplifies the quintessential way of the Tao (*Dao* 道).

In body motion, the yin-yang imbalance is manifested in the musculo-skeletal structure as an excess or deficiency in the activation levels of muscles in the support at the joints. The quest of Taiji balance is thus then reduced to resolving the imbalances of muscle activations, but what is the body cognition of this imbalance?

The Taiji journey is to cultivate this cognition and to develop the tools to reduce the errors of imbalance, which is a continual process that entails the cultivation of qi energy and the discipline of meditation. Are the neural circuitries of the brain predisposed to the principle of inner balance?

The brain is not wired to respect inner balance

Our bipedal structure is inherently unstable, not unlike that of an inverted pendulum, where any movement or perturbation would cause it to fall. The reason we are not falling is because the body is kept in physical balance by constant muscle adjustments, monitored by the inner ear and proprioceptors, and regulated in the cerebellum and the brain stem, without conscious input.

Although the brain is wired to activate muscles to keep balance, it pays little or no heed to the body structure, as seen in the unsound leaning posture forced in the incident of picking up a box. That is, the “natural response” to keep balance is an immediate-term answer, which does not consider inner balance. Worst still, more often than not, the response compromises inner balance. In other words, the neural circuitries are not programmed to reliably recruit the right combination of muscles that can perform a task better. Indeed, the exertion in the imbalance of muscle activations may end up causing injuries to the knees, ankles or back, as witnessed in sports, martial arts, dance and the workplace. In short, the brain is not wired to respect inner balance.

This means that we are not wired to deliver a knockout punch or a long drive in golf unless we are trained or talented. Also, the responses of muscle activations, which have become habitual, are not geared for high-level performance. That is why as much as a weekend golfer tries, he cannot produce the long drives of a professional golfer—the inner balance is not resolved. The novice golfer swings the club hard thinking that the harder he strikes at the ball, the further it would go. However, the anxiousness for a long drive triggers the activations of the prime moving muscles of the shoulders and arms to lead in the golf swing, resulting in the arms jumping ahead of the body’s waist rotation in the action. The swinging action is deprived of the muscle power of the lower body. Moreover, in the action, the right side tends to dominate (for a right-hand drive), dragging at the left side. The drive suffers because muscle power has to be diverted to

compensate for the effects of muscle actions that are not aligned and balanced internally. There is no faculty in the brain to assess the selection of muscle activations that would produce a better outcome of power action.

Nevertheless, the neural circuitries provide responses that work amazingly well in bipedal balance and functionality. Although they are not wired to assess inner balance, the neural circuitries provide for a wide variety of general pattern generators for walking, swimming, and the many movements associated with common actions.

However, inner balance is critical in generating the waist power necessary for performance in sports and martial arts. Physics tells us that the torque action of the upper body has to be supported by the torque reaction of the lower body in the opposite direction. The action-reaction junction occurs at the waist—hence waist power—where the mass distribution between the upper and lower body is most proportionate.

The Chinese term for this waist junction is more specific, called the *kua* 胯 (the hip-joint junction). The Chinese terminology for waist power is *dang-yao jin* 裆腰劲. *Dang* refers to the groin region, and *yao*, the waist. So the terminology of *dang-yao jin* captures more precisely the torque action-reaction of waist power. To tap fully the potential of waist power requires the balance between the muscle activations of the upper and lower body, as well as between the left and right, which are issues of inner balance.

The physics part is easy. The hard part is to get the stubborn body to respect inner balance in its actions. The Taiji methodology of resolving yin-yang imbalances of muscle activations is to infuse the principle of inner balance in the body. The slow-motion training breaks the habitual ways of muscle activations, and builds a response system that automatically incorporates the factor of inner balance. It develops neural circuitries to respond with inner balance instead of just physical balance.

Fangsong 放松 and qi 气

The question of the cognition of imbalance is tricky because we do not have an awareness of the muscle actions. We can deduce the imbalance of muscle activations from its effects, which may be too late for in some circumstances. For example, we become aware of our physical balance only after it is lost. However, we can learn to be cognitive of the effects of imbalance, such as tenseness and stiffness.

Let us examine the balance in an arm extended to the side, shoulder level, common in Taiji form movements, such as the posture of *Lanzhayi* (“Lazy Tying Coat”). Hold the arm in position for a period of time and tenseness would set in quickly, especially for a beginner, which is an indication that certain muscles—often the shoulder muscles—were working harder. The tenseness or *jiang jin* 僵劲 is a symptom of inner imbalance of muscle activations.

The sensation of tenseness elicits a response to relieve it, by relaxing or “letting go” of the tense muscle support, which in Chinese is called *fangsong*. The fangsong

mechanism works by the resettling of the muscle actions to another level of support of the arm, with less tenseness, and thus improving the balance of the arm. This fangsong mechanism can be simulated by someone holding the tip of finger, and letting the arm fall as a cable between the shoulder and the finger support. Or it can be induced by "sinking the shoulder, and dropping the elbow (*chen jian zhui zhou*)." In the resettling of the muscles, the prime-mover muscles are restrained. With less hindrance of tenseness induced by fangsong, the body (usually the hands first) senses a flow of energy, which is ascribed to as qi energy.

In effect, the fangsong mechanism cultivates an association of a reduction of the errors of imbalance at the joints with the sensation of qi flow, which represents the rudiments of the perception of inner balance. From the standpoint of practice, fangsong generates qi—the more fangsong-relaxed, the more qi. Then as qi matures, one can use qi as a medium to discipline muscle actions—the more the ease of qi flow the better the balance. In the process, the body gains awareness of the elbow and the wrist, as well as the weight and the qi-connectedness of the arm.

There is another aspect to the fangsong relaxation. The fangsong mechanism does not render the support of the arm lax or languid, like a drooping house plant that has not been watered. If the support is lax, there would be a loss of qi connectedness in the arm (*diu* 丢), analogous to a slack cord or a garden hose with no water.

Stretching the arm physically to seemingly correct the slackness would introduce tenseness in the arm. The Taiji instruction to correct for this *diu* looseness is *shen jing ba gu* 伸筋拔骨 ("stretch the tendons and bones"). This simulates an "internal stretching" that works to add tension to the slackness without causing tenseness, which nurtures a connectedness of qi in the arm as it relaxes. In other words, the mechanism of fangsong is one of alternating between relaxation and internal stretching to reduce the errors of muscle actions, which cultivates qi in the process.

Although the mechanisms of fangsong and qi are discussed using the arm as an illustration, the principle applies to any part or joint of the body to nurture inner balance, and thus qi throughout the body. The qi developed charges the motion of Taijiquan to render it fluid and strong.

In summary, fangsong is not only an antidote to *jiang jin* or tenseness, but more importantly, it nurtures inner balance and cultivates qi, and along with it, develops body awareness of the joints and qi-connectedness of the body.

"Use mind intent not use force" (*Yong yi by yong li*)

A most important guiding principle in Taijiquan practice is to "use mind-intent, not use force" (*yong yi bu yong li* 用意不用力). The principle is exalted as governing the whole practice of Taijiquan (*ci quan shi yong yi bu yong li* ā Ŋ Ą ▄ Ū ă ▄ ļ).[3] The practitioner is constantly admonished to abide by the practice dictum. However, the rule has created the most confusion in practice. "Not to use *li* (force)" is often interpreted as not to use

muscular force, which of course is meaningless as movement is powered by the contractile actions of muscles. This interpretation is also the reason why Taijiquan literature disdains the talk of muscles.

The overriding concern is that if one practices contrary to the principle—using *li* and not using *yi*—it would invariably cause tenseness (*jiang jin* 僵劲) and thus qi blockage and clumsy strength (*zhuo jin* 拙劲). We examine the implication of "using *li*" in terms of muscle activations with regard to balance to address the concern.

Muscle activations in physical movements are divided into three functional groups: the agonists, which are the prime movers (for example, the biceps in flexing the arm), the antagonists that oppose the agonists to provide smoothness and control of the movement (the triceps and biceps work in antagonistic pairs), and the synergists, which secure and stabilize the joints, and function to support and help in the movement (the brachialis and the coracobrachialis seated beneath the biceps, and others).

Taijiquan's training methodology relies on a simpler basis of two functional groups: 1) muscles that function primarily as prime movers of a movement, called "outer muscles," and 2) muscles that function primarily to secure and stabilize the skeletal bones and joints, and to assist the prime movers, called "inner muscles." The division is not necessarily physical nor exclusive. The outer muscles are usually the superficial muscles that function as agonists or antagonists, and the inner muscles are usually more deeply seated, and function as synergists. In practice, the difference is relative—to restrain the outer muscles and let the inner muscles align.

The command to execute a movement activates both the inner and outer muscles, but the levels of their activation are not the same, which can result in muscle stress and thus the quality balance. By habit and convenience, the outer muscles tend to dominate without attending to their alignment with the inner muscles. As a consequence, there would be an offset in the balance at the joints, and would trigger the inner muscles to fire at higher levels to compensate in their function to stabilize and secure the joints, introducing stress, which would in turn impinge on the ease of motion flow, the symptom of tenseness.

"Not to use *li* (force)" in the practice dictum subdues the domination of the outer muscles. It does not mean not to use muscle force, but rather not to use outer muscles to curb its dominance. The fangsong resolution guided by the dictum in slow motion works operationally to restrain the outer muscles. At the same time, "using *yi* (mind)" allows the inner muscles to activate in alignment and balance with the outer muscles, thus nurturing inner balance and qi. In this way, the process would eliminate the slightest presence of "clumsy" *zhuo li* (ă ﹾ Đ ┣ ″Hġ □ ﹾ).

Paramount status of the kua junction and dantian qi

The wily business of the fangsong resolution is that we have hundreds of joints, and the body-frame has a certain tensile integrity. Resolving the imbalances joint by joint is

daunting enough, but what is more daunting is that the resolution at one joint affects the balance at the other joints, because of the tensile integrity, thus requiring a recalibration each time. This need for constant feedback and readjustments of muscle activations at multiple joints seem an impossible task. However, not knowing the anatomy or neural circuitries did not stymie Taiji masters of old.

We turn to the ingenuity of Taijiquan again. Ironically, we find the answers to this complex problem in the traditional and arcane concepts of qi and *dantian* 丹田. *Dantian* ("field of elixir") is a point in the lower abdominal region, three fingers below the navel, and about a third of the way inside.

First of all, in the training methodology, the "hundred" joints are simplified and subdivided into sections so that one can work through them systematically. This is expounded in the *Principle of the Three Unities (Sanhe 三和),* the *Principle of Three Sections (Sanjie 三节)*, and *the Principle of Four Extremities (Sishao 四梢),* found in the essay, *Ten Essential Principles of Taijiquan,* by Chen Changxing, the 14th generation Chen Family patriarch. In essence, the *Sanjie* and *Sanhe* principles subdivide the body-frame into three subsections, as well as correspondences of the three major joints: shoulder and hips (*kua*), the elbows and knees, and the hands and feet. (A more thorough discussion of these principles is found in the author's book.[4])

The hips (*kua* 胯) are preeminent among the joints of the human bipedal structure. The *kua* refers more to the inguinal fold and represents the junction where the motion divides between the upper and lower body. The inner balance of the *kua* is critical to the comprehensiveness of bipedal balance and functionality. For example, the generation of waist power (*dang-yao jin*), relies on the torque action and reaction at this junction. The *kua* is thus accorded a paramount status, and the dantian lies functionally midway between the *kua*.

The methodology looks to the *kua* as a base of reference to resolve the yin-yang imbalances. It starts with the resolution of the imbalance of muscle activations at the *kua*, which is referenced to the dantian center so that the fangsong can work on the internal motion of the left and right hip joints. This builds a foundation of balance at the *kua* junction relative to the dantian. This key foundational balance will be reexamined in the next section.

With this foundation, the fangsong resolution of the shoulder joints in conjunction with the *kua* relative to the dantian center—of the shoulder-kua correspondence—can be made. By extending the process, the fangsong resolution can be applied to the other corresponding pairs: the elbows and knees, and then the hands and feet. In the systematic approach to fangsong at the joints, the associated qi flow extends throughout the body. This establishes the dantian as the central station to assess the muscle activations and qi flow.

The dantian as a reference point serves to centralize the feedback issues of the fangsong resolution and qi flow of all the joints. This means that the recalibration of

balance at the other joints triggered by the fangsong action initiated at each joint is built into the process, by virtue of the centrality of the dantian, as well as by the principle of the unities of the three correspondences (the *Principle of Sanhe*). In practice, it is far easier—the methodology simply asks the practitioner to continually apply fangsong to resolve the muscle activations with reference to the dantian. In doing so it is also building a connectivity of motion and qi between the dantian and the joint being worked on, and the intervening joints. In effect, the fangsong resolution grows in sophistication working on the imbalances as perceived in the dantian.

Corresponding to the resolution of imbalance is the qi nurtured, which gradually fills the whole body. The continual focus at the dantian induces the qi to settle and accumulate in the lower abdominal region, and "the qi to sink in the dantian" (*qi chen dantian* 气沉丹田). In other words, the qi concentrates at the dantian as it extends to fill the body. As the fullness of qi forms, it defines a web of qi-connectivity centered at the dantian. The fullness of dantian qi (*dantian qi baoman* 丹田气饱满) establishes the central status of the dantian—the actualization of the dantian as the center of the body-wide connectivity of qi.

The actualization of dantian centrality represents the unification of qi and motion, and of dantian qi and inner balance. Indeed, the fullness of dantian qi signifies the crowning achievement of inner balance, and represents the attainment of the mastery of the art.

It is easy to be misled to regard some qi sensation at the dantian region as dantian qi. Dantian qi does not indicate a local condition; it represents a body-wide qi connectivity nurtured in the fangsong play of the multiple series of muscle activations between the joints and the dantian. The sequential activations build up the energy of the muscle actions without compromising inner balance at each stage, which culminates as the fullness of dantian qi—the realization of the central status of the dantian.

The core balance of the lumbar vertebrae at the pelvic seat

Given the critical role of dantian centrality, it is imperative that we examine in more detail the structure of the lower back and kua at the dantian region. Studying the inner muscles that secure and stabilize the vertebral structure of the lumbar at the pelvic seat, it becomes clear that the integrity of the lumbar-pelvic support is core to bipedal balance, and that is insight of the principle of dantian centrality.

The skeletal frame of the ribcage sticking out and hanging on the vertebral column at the upper part, and at the lower, the sacrum sitting on the pelvic base, cannot be more structurally unsound. There are no other skeletal props that hold up the ribcage besides the vertebral column. But, dressed up in muscles, the bipedal structure delivers a remarkable range of versatility in mobility and function. This bipedal functionality rides critically on the integrity of the lumbar support on the pelvic base.

Ironically, it is the precarious structure of skeletal prop that is ingeniously being exploited to great advantage, to provide agility and liveliness. A series of three deep

muscles hold the lumbar vertebrae to the pelvic crest and the thigh bone (femur) just below the head: The top part of the psoas muscles attaches to the lumbar vertebrates, and the bottom part to the femur head. The iliacus muscles also attaches to the femur head, but its top part is attached to the pelvic crest (iliac crest). Together these two muscles are referred to as iliopsoas. The third muscle is the quadratus lumborum, which lays behind the psoas band; it binds the lumbar vertebrae to the pelvic crest at the back (Fig 1). These three lumbar-iliac muscles work in synergy in their primary function to secure and stabilize the erect structure at the lumbar region. The balance of the activations of these inner muscle is thus a core factor affecting all bipedal functionality.The muscles also support lateral flexion, the side-to-side bending of the trunk.

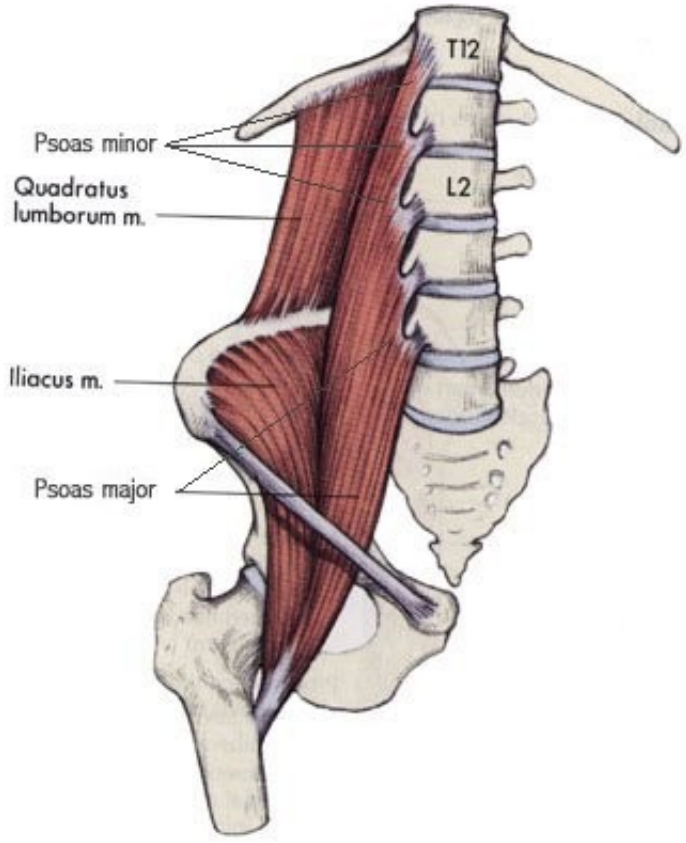

Fig 1. The three lumbar-iliac muscles securing the lumbar vertebrae

Wrapping around the midsection like a corset are two halves of the abdominal muscle sheets (the inner tranversus and the two oblique muscles) that zip together at the abdominal fascia (aponeurosis) in the front, forming the midline (called linea alba), and at the back they attach to the thoraclumbar fascia. Each half of the muscle sheet is innervated independently, and works in combinations with the other half sheets in coordination to produce the versatile motions at the waist, in addition to supporting the rectitude of the lower back and the midsection. The abdominal muscles maintain their flexibility of functions even as they expand hugely in pregnancies (and in beer bellies).

Even though the lumbar-iliac muscles are not mentioned in the earlier fangsong discussion, they are nevertheless in fangsong play with the outer muscles at the kua, as well as the abdominal muscles. That is, the mindful and slow-motion methodology of the fangsong resolution of the kua-abdominal region is inducing the lumbar-iliac muscles to activate in alignment and balance with the outer muscles, which are also being restrained from overwhelming and obscuring the inner muscles. This strengthens the lower back, and more importantly, maintains the integrity of the precarious lumbar-pelvic structure as a matter of course in the body's response.

However, very often at work, play, and sports, the inner muscles of the lower back are overwhelmed by the dominance of the outer muscles in actions. To maintain balance, the body responds by activating the lumbar-iliac muscles at heightened levels, breaching further the inner balance. The muscle power used to compensate for this offset in balance tenses up the motion, and detracts from the performance. More sinisterly, in time, the stress of the excess of activation results in feverish back aches.

Lying supine allows the back muscles to rest and relax, which brings some temporary relief, like hot plasters, rubs and massage. But they do not address the issue of imbalance that causes it. In this regard, Taijiquan practice has proven to be a most effective exercise therapy to ameliorate backaches.

From the perspective of performance, we can attribute the body's inability to bring out the full potential of its power to the failure to maintain the integrity of the core inner balance, which is easily compromised by the tendency of the outer muscles to dominate in action. Hence, Taijiquan, with its roots in martial arts, is primarily invested in cultivating inner balance at the kua and dantian. The resolution of the activations of this critical balance is incorporated operationally in the fangsong play by the constant focus at the dantian throughout the practice.

The maturation of dantian centrality relies critically on the lumbar-iliac muscles to secure and keep intact the lower lumbar support at the pelvic base. The resolution of these inner muscles and the abdominal muscles represents the deepest internal fangsong play that must be reached in order to develop full dantian qi, and thus true centrality. This development entails the practice of standing meditation—staying stationary in a posture for a long duration.

Using dantian qi to regulate motion

The actualization of dantian centrality signifies that the dantian qi is full and can be used to detect yin-yang imbalance in any part of the body through the qi medium, analogous to a liquid bubble in a leveler. We use dantian qi to decipher and discipline the activations of the inner and other muscles. In this sense, we use dantian qi to regulate Taiji motion.

This brings us to the *yi-qi-motion* paradigm of generating motion as perceived by the body in the qi medium: *yi* (mind-intent) commands, *yi* initiates, qi arrives; qi arrives,

body moves (y*i dao, qi dao, qi dao, shen dong* 意到气到,气到身动). How does this fit into the model of the motor cortex sending signals to the motor neurons through the cortico-spinal tract, that innervate the muscles to produce motion?

The yi-qi-motion paradigm describes how the body produces motion as it is perceived and guided by Taijiquan practice. In executing the motion following the *yi* command, the principle of inner balance disciplines the activations of the inner and outer muscles to balance and align, with a corresponding qi flow, which is perceived by the body as qi arriving from the yi-signal. The experience of qi arriving is an input of qi signaling that there is balance, which then modulates the output signals to the motor neurons to activate the muscles. The motion that ensues is thus regulated by inner balance. That is to say, the motion initiated by dantian qi is modulated by qi to maintain inner balance in the action. In the accord of motion and qi, the dantian is “happy.”

To recapitulate, the motion initiated by dantian qi keeps intact the integrity of support of the lumbar-pelvic structure—the lumbar-iliac muscles are engaged in balance at the core in the motion. Secured and stabilized thus by the inner muscles, the activations of the abdominal muscles, the erectus spinae and the abdominal erectus, and that of the other outer muscles can align and not jump out of sequence to compromise balance.

Therefore, the discipline of Taiji motion is reduced to motion initiated by dantian qi. This means that Taiji motion can be studied by the different ways of manipulating dantian qi. This is presented as “dantian internal rotation” (*dantian neizhuan* 丹田内转), which Chen Xiaowang classifies as of three modes, which the reader can pursue in the author's book.[5]

We conclude this section with the Principle of Motion (*Yundong Guili* 运动规律), which encapsulates Chen Xiaowang's teachings on dantian centrality:

Principle of Motion

Yi dantian wei hexin 以丹田为核心
Yi dong quan shen bi dong 一动全身必动
Jie jie guan chuang 节节贯穿
Yi qi guan tong 一气贯通

Establish the central status of the dantian
One part moves, whole body moves
Qi threading through every joint
The qi unifies as one with motion.

Inner Strength (*Neijin*) and Dantian Centrality

Taijiquan as a martial art never fails to intrigue—the gentle and slow motion that characterizes the training cannot be more antithetical to the speed and power of a

knock out punch or to the strength of muscle mass. Taijiquan does not just boast of excellence in kungfu skills, but of extraordinary martial prowess—it produces invincible kungfu heroes without peers.

In fact, *Taijiquan Classics*[6] immodestly touts its own art as superior to other martial systems, decrying the others as, without exception, only about the stronger bullying and subduing the weaker (*gai bu wai hu zhuang qi ruo* 概不外乎壮欺弱). Taijiquan kungfu skills are singular—about the "weaker defeating the stronger," and "the slower hand beating the faster," epitomized by the skill of "four ounces overcoming a thousand pounds" (*si liang bo qian jin* 四两拨千斤).

The other oft-cited kungful skills that exemplify Taijiquan's extraordinariness include:

Yin jin luo kong
Lead opponent's attacking force to emptiness

Jie li lai da ren
Borrow opponent's force to strike back

Yi rou ke gang
Using "softness" to overcome "hardness"

These embody the kungfu art of not relying on superior strength, and not fighting force with force. Rather they describe techniques that do not fit into the usual narrative of combat, which emphasizes speed, power, and muscle mass. In fact, the kungfu skills appear to defy the laws of physics. But none have led to any new physics.

The source of these wondrous kungfu flows from the principle of dantian centrality, which endows the body with *neijin* or inner strength. The term *nei* 内 (inner) is used because the skills seem effortless and are not physically apparent—the underlying strength is hidden. Often *neijin* is simply referred to as *jin,* dropping the qualification of *nei* as superfluous.

If Taijiquan masters can be distinguished, it is by the ordinariness of their physique, which underscores that the development is not external. Often the fascinating skills are depicted by an old man handling and dispelling with ease a bunch of tough hooligans descending on him. This depiction is not an exaggeration of Taijiquan's martial skills. The wonderment of the Taijiquan kungfu titillates only because one is not cognizant of neijin—the strength of inner balance.

Neijin has two characters: "soft" *rou* 柔 and "hard" *gang* 刚. The *rou*-softness refers to the fluidity of the body structure rendered by motion at the joints. The *gang*-hardness refers to the body structure moving as a frame, which unifies mass in motion. In other words, *gang* manifests as a frame, and *rou* as the dynamics that form the frame. Though opposite in character, *gang* and *rou* are complementary, and they mutually aid one another (*gang rou xiang ji*).

In Taiji training, the fangsong attentiveness to the effects of muscle activations nurtures the body's awareness of the movements at the joints, and at the same time, the whole structure of the frame. It cultivates the *rou* character, associating it with the ease of movements at the joints, and develops the *gang* character with the body moving as a whole, which unifies mass in momentum. In this way, the fangsong training inculcates the principle of *rou* and *gang* in the body.

Moving at the joints to manifest *rou* or as a frame, *gang*, may seem obvious, but not for the body, especially when it is under pressure. For example, when captured in an armlock, under pressure and pain, the arm becomes locked and cannot maneuver like a wheel that is blocked. With the principle of *rou*, the body knows it is not rigid like the spokes of the blocked wheel, but can turn at smaller radii at the appropriate joints, and thus to escape from the armlock.

The magic of *jin* in Taijiquan kungfu lies in the body's spontaneous response in *rou* or *gang*, and their interchange, to meet the challenge as the combat situation demands. The opponent encounters a body that is both soft and hard, supple and firm, lively (*qing ling* 轻灵) and stable (稳重)—the target seems to dissolve in the face of attack. Where is the force and how does the *rou* and *gang* of *jin* relate to force?

The force of neijin

As mentioned earlier, Taijiquan disdains the talk of physical force. The constant exhortation of “not to use *li* 力 (force)” has become so ingrained in the psyche that it has created a phobia of using anything that is perceived as *li* in Taijiquan. Taijiquan uses the character 劲 *jin* to refer to power and strength, which etymologically indicates that it is a highly trained and refined kind of *li* 力. Implicitly, *jin* is more than strength. *Jin* is precise, maneuverable through its *rou* and *gang*, and is responsive and lively.

Taijiquan training is directed at cultivating *jin* 劲 not *li* 力. Indeed, the differentiation of *jin* 劲 and *li* 力 is often used to define what is or is not Taijiquan. *Jin* is developed by the Taiji methods of internal training. The strength that one builds in physical exercises, such as weight-lifting, is that of *li*, not of *jin*—it lacks the dimensions of *jin*.

The confusion in the interpretation of *jin* and *li* is unavoidable as *jin* is a highly specific terminology in Taijiquan, while *li* is a term of common usage. In the culture of Taijiquan, *jin* is exalted while *li* is denigrated.

In physics, force is a vector of direction and magnitude, and there is no issue as to whether it is inspired internally or externally. For example, in a knockout punch, physics does not distinguish between *jin* or *li*, only the impact force produced in the collision between the fist and the head. In fact, the same punch does not deliver the same force, not because it is that of a boxer or a Taijiquan expert, but on what is struck, a pillow, a board or a brick, or where in the body, the belly or the head.

The body produces two kinds of force: the force of the contractile actions of muscles that moves the body, and the force that results when the body's motion is obstructed or resisted. We do not experience directly the force of the muscles, but we experience the force directly when body motion is obstructed or resisted. The latter is the force that inflicts damage when the fist, foot, elbow or knee collides with the opponent's body in a strike.[7]

This force is Newton's Second Law of Motion, which states:

Average force = Change in Momentum/Time duration for the change to occur.

The issue of how the motion is generated does not arise, but it is clear that a well-delivered waist-powered punch can cause a concussion, while that of only the arm swinging, only a bloodied nose. The difference between *jin* and *li* lies not in the force per se, but in the quality of body motion produced—the composition of the underlying muscle actions. The quest of *jin* is therefore about the training to produce the ideal kind of motion, and Taijiquan's answer is to seek that which conforms to Taiji principles.

Definition of the force of jin

The *force of jin or neijin* is the force that arises from body motion that conforms with yin-yang balance—the inner balance of the dynamics of muscle activations underlying the support of the posture or action.

Although articulated in terms of yin and yang, inner balance is concretely represented in terms of muscle activations, and is resolvable pragmatically via the medium of qi by fangsong. In practice, its quest is reduced to the development of full dantian qi, the achievement of which culminates in the formation of the central status of the dantian.

The fruit of the kungfu efforts is that with dantian centrality, motion is unified with qi—the motion is fluid and can change with ease, not strained or locked as in exertion. The body experiences the qi-charged motion as *jin*, and the qi-connectivity as jin-connectivity centered at the dantian. The *jin* emanating at any part of the body is supported by the *jin* reaction at the dantian center, and is balanced.

Regulated by the principle of dantian centrality, inner balance underpins all the body's actions and postures. In any breach of balance, muscle power would have to be expended to compensate for the errors of imbalance, which would detract from the force generated. Therefore, the force of *jin,* with its basis of inner balance, is consummate.

Using *rou* and *gang* to manipulate the force of *jin*

While we may compute the force vector to apply in physics, but the body does not relate to the vector values of force in its response. How does the body generate the force needed in application, which has to be variable to meet changing circumstances?

The body can only generate motion, not force. However, with dantian qi, the motion generated is unified with qi. So the body gets a feedback of qi in the qi-connectivity centered at the dantian, which is experienced as a feedback of the *rou* or *gang* of *jin.* With inner balance, the feedback of *jin* modulates the qi-motion, resulting in the *jin* response that corresponds to the force needed, and the response changes as the situation charges. In short, the body manipulates the force vector of *jin* through the response of *rou* and *gang* in the right balance.

In application, the Taiji body meets an incoming force by receiving it with the softness of *jin* to absorb it, like a shock absorber, which at the same time manipulates the receiving angle of the force, thus lessening its impact. The *rou*-soft response uses the body's cognition of the movements at the joints. On the other hand, to generate the force of *jin* to repel an opponent, the body responds with *gang*-hardness as a frame, which unifies more mass in motion, thus generating a greater momentum.

The proficiency of *jin* maneuvers in kungfu rely on the ease of change between the *rou* and *gang,* which hinges on the body's inner balance staying intact in the response, which is accorded by the principle of dantian centrality. It can be said that the neural circuitries are being wired by the constant reference to settle in the *kua* and to center at the dantian, in the cultivation of dantian centrality. So ingrained with the principle, the body responds by reflex to keep inner balance in the change between *rou* and *gang*. In other words, with dantian centrality, all the body's actions, whether in defense or offense, are underpinned by inner balance.

Mechanics of Taijiquan's kungfu skills

All Taijiquan's kungfu skills rely on the spontaneous ease of change in the *jin* response between *rou* and *gang*, and the maintenance of inner balance. For example, in the skill of “leading an opponent’s attacking force to emptiness” (*yin jin luo kong*), the body's *jin* receives the incoming force with *rou*-softness to lessen its impact. With the *jin* of inner balance staying the opponent's force, one can turn at the waist to guide the force away from harm's way and into “emptiness.” Without inner balance, one might not be able to turn, being locked by the body reaction to push back, and without a sufficient store of *gongli* 功力 (developed basic strength) of the *jin* of inner balance (*peng jin*) to stay the opponent's force in the maneuver, one might have been shoved off before any skills could apply. This epitomizes the art of using “softness” to overcome “hardness” (*yi rou ke gang*), which relies on the ease of change between *rou* and *gang*.

With the force guided away from the target, the force dissipates and the opponent falters. Then one takes advantage of (*de ji de shi* 得机得勢) the faltering momentum —“borrowing” his momentum to propel him off (*jie li lai da ren*), by the body spontaneously responding with *gang jin*. The opponent is seen thrown away at a great distance with seemingly little effort—much less than one would expect needed in the throw.

The technique of “four ounces repelling a thousand pounds” (*si liang bo qian jin*) also fits into the genre of “leading an opponent’s attacking force to emptiness” in that only a small force is needed to guide the strong attacking force off. But the technique points more to a leverage of tremendous advantage. Galileo boasted more grandly that he could move the earth if he could have a long enough lever, and a place to position the fulcrum to apply the lever. In order for a small effort of four ounces to move a thousand pounds placed at six inches from a fulcrum, the lever would have to be over an unmanageable length of 2000 feet. The human anatomy cannot facilitate a linear leverage of great advantage.

The remarkable advantage of leverage alluded to in Taijiquan comes from *chanrao* 缠绕 (coiling motion) in emulating the leverage of a screwdriver. That is the advantage of controlling the handle of a screwdriver against an opponent holding the tip. The rotation of the dantian initiates the waist-kua turning of the body, which acts as the handle turning a screwdriver. For instance, if one's arm is seized in an opponent's grip, one can turn at the waist-kua as the handle of screwdriver, to act against the opponent's hold, as at the tip. With the overwhelming advantage of the screwdriver leverage, no matter how big or strong the opponent, the grip is broken.

The effectiveness of the coiling leverage relies critically on the body's *jin* connectivity centered at the dantian. The response of the jin's *rou* and *gang* allows the coiling radii to vary in accordance with the load to generate the torque necessary in the leverage. In other words, the advantage of the *chanrao* action relies on the principle of dantian centrality, applied in the body's rotational motions.

The *chanrao* action is powered by the *jin* of the body's rotational motions—a series of self and general rotations. This *jin* is developed by the practice of *chansi* 缠丝 (“silk-reeling”) motion. The *chansi* element is present in all body motion, so is practiced in all martial arts, but is explicitly delineated in the Chen Style Taijiquan, which incorporates it at the basic level from the outset of training. The *chansi* training in essence brings coherence to the series of self and general rotations. *Chansi jin* is the *jin* that arises from *chansi* motion. For a more detailed discussion, the reader is referred to the chapter on *Chansijin* in the author's book.[8]

From this perspective, we say that Taiji motion is powered by *chansi jin*. Indeed, all of the kungfu skills are tapped from *chansi jin*. This includes *qinna*, the art of capturing joints and pinching nerves to immobilize an opponent, and the escape from same. The power of *dang-yao jin* (waist power) and *fajin* (the explosive release of energy) are expressions of *chansi jin*.

Tang Hao (1897-1959), the grand martial arts historian, noted that the martial application of *chanrao* was first codified in the verse in the *Song of Boxing Canon* by Chen Wangting:

Zhu kao chanrao wo jie yi 诸靠缠绕我皆依
I fully rely on coiling as the basis of all my kungfu techniques.

Chen Wangting (c. 1600-1680) was the ninth-generation patriarch of the Chen Family, who reinvented the family's martial arts tradition, which would become known as Taijiquan.

Conclusion

While it is true that the science in the exposition may not capture the full range of individual experiences of qi and *jin* with their subtle nuances, it is more true to say that without coiling leverage, there would be no phenomenon of "*si liang bo qian jin*." Without the dynamic force vectors of *jin* (produced by the maneuver of its *rou* and *gang*) there would not be the art of "*yi rou ke gang*." Without the opponent's faltering momentum, there would be no "*jie li lai da ren.*" One would not be able to execute waist power (*dang-yao jin)* effectively if the action of the upper body is not supported by the reaction of the lower body, and the *jin* of the left and right are not balanced, namely, if the action *jin* and the reaction *jin* do not align to abide by Newton's Third Law of Motion ("Action equals Reaction").

By injecting physics and physiology into the discussion, and by bringing the role of muscle force and activations into the forefront, rather than shunning it as in traditional exposition, we gain the precision of science in the biomechanics of *neijin*. With that understanding we can train more effectively, and rely less on secrecy and nebulous methods that expect decades of devotion to gain mastery.

It is not the place of science to contravene the metaphysics of Taiji. However, physics and physiology are not inconsistent with the theory of Taijiquan, as manifested in the musculo-skeletal framework. The kungfu skills of Taijiquan may appear to defy the laws of physics, but they nevertheless find their basis in science. In other words, physics and physiology explain Taijquan, but it is the yin-yang metaphysics of Taiji that delivers the goods to the body. By reducing the practice to the development of dantian centrality, the yin-yang methodology of Taiji cuts through the maze of neural networks and the complex of muscle activations to regulate and generate motion that conform with the yin-yang principles, and thus the delivery of the consummate force of *neijin*.

To conclude, keep the dantian happy!

1 Chen Xiaowng (2008) *Chen Family Taijiquan*. The discussion on theory, *Taiji Essence*, is entirely devoted to the central status of the dantian. p. 308.
2 CCTV Oct 2012 https://www.youtube.com/watch?v=FtCfUaL-leo
3 Chen Weiming. *Yang Chengfu's Taijiquan Theory of Ten Essentials* г □ □ Ā . □ ←Ґ Ł
4 C.P.Ong (2013). *Taijiquan: Cultivating Inner Strength*. Chapter 7.
5 Ibid 3. *Dantian Internal Rotation (Dantian neizhuan)*. p.209.
6 Wang Zongyue. *Taijiquan Classics*. One of the five canons of Taijiquan.
7 Ibid 3 More detailed discussion in *Momentum* p. 116.
8 Ibid 3. Chapter 8, *Theory of Chansijin*. p. 193