

Scientific Perspective of Neijin (Internal Strength)

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Summary

This paper studies body motion that gives rise to the phenomenon of neijin, and the biomechanics of the strength generated in the actions. It looks at the muscle actions underlying the internal movements at the joints, and how they must align and balance to harness the body's full potential to produce power and strength. For that, the many segments of the body must move in tandem and in harmony with the internal movements, to unify momentum.

The muscle actions that we seek are those that conform to the principle of *inner balance*. Inner balance endows the body with an ease of change internally at the joints and an unforced and smooth flow of motion through the body without resistance. Imbued with inner balance, the body responds spontaneously to maintain balance and structural integrity when interacting with an external agent, such as in combat.

However, the body is stubborn in its habits of recruiting muscles, which often turn out to frustrate the intended purpose of the action. To resolve this issue of neurobiology in training, Taijiquan resorts to the traditional concepts of Qi and the yin-yang theory to infuse the principle of inner balance in the body. In essence, Taiji cultivates qi associated with the factors of inner balance, and then uses the qi medium to generate the ideal body motion, that which is in accord with Taiji principles.

What is neijin?

Neijin 内劲 is the wondrous stuff behind the prowess of the kungfu of Taijiquan. What fascinates is that the kungfu application appears effortless with hardly any physical exertion of force—hidden so to speak. It seems that Physics is turning on its head—the “weaker” overcoming the “stronger” and the “slower” beating “faster.”

What fuels its mystery is that the ethos of Taijiquan resides in the internal, not characterized by external attributes of strength, like muscle bulk or vigor of physical activities that we are familiar with. Indeed, the only thing extraordinary about Taijiquan masters is that they are distinguished by the ordinariness of their physique. The gentle and slow motion that defines the art cannot be more remote from the speed and power of a knockout punch. That is the mystique of Taijiquan's neijin. So what Taiji practitioner or martial artist would not harbor the dream of developing the magic of neijin?

In explaining neijin, Grandmaster Chen Xiaowang says that the strength from Qi alone is not great, and the strength of muscle force without Qi is crude and brittle. Paraphrasing Chen Xiaowang in the expression of an equation, we have the quick answer of neijin:

Neijin = Muscle actions + Qi.

The answer is encouraging as it indicates that one is building a store of neijin in Taijiquan practice: One is nurturing Qi and Taijiquan movements entail muscle actions. For that matter, all oriental martial arts train to develop Qi (Ki in Japanese) as well.

But where is the stuff of neijin? Many have practiced for years without getting it. Not every Taijiquan practitioner can tap into neijin to beat back a bully. Neijin is illusive. That is what makes the quest of this soft strength of neijin fascinating and challenging.

So the quick answer of neijin needs a lot of supplementals in exposition. What is Qi and how does it meld in with muscle actions? A good place to start is at the waist. We use the waist to generate power actions in sports and martial arts, as well as at work, hence the term waist power. But waist power does seem mundane in light of the grandiose of neijin intimated. That may be so, but think about it—we ruefully fall far short of our potential to produce the waist power that the body is capable of, and we seem limited in our ability to improve upon it in training. Weekend golfers know well the limits of the range of their drives. This problem is at the heart of the training to develop the power of neijin.

Taijiquan relies on waist power, but the Chinese term for it is more specific, called *dang-yao jin* 裆腰劲, which translates as *waist-groin* power. The terminology indicates that the power is derived from the pairing the actions of the groin (*dang*) and waist (*yao*). Generating waist power requires the play of the pelvic platform, called the *kua* 胯. Thus, Taijiquan places the greatest emphasis on the *kua* in practice.

Here we look at waist power through the lens of Taijiquan. The study shines the light of science at neijin as it manifests in the body, and opens up the esoteric Taiji yin-yang theory and the role of qi in the musculoskeletal framework.

The eminent status of the waist-groin region is enshrined in the canons of Taijiquan.¹ The classical literatures are replete with references to the waist-groin as the center of control:

Control center is at the waist

Zhu zai yu yao xing yu shou zhi 主宰于腰形于手指

Mind intent commands, motion originates at the waist region

Ming yi yuan tou zai yao ji 命意源头在腰际

Be attentive at all times to the waist region

Ke ke liu xin zai yao jian 刻刻留心在腰间

Relax completely the abdomen and qi soars

Settle the tail bone centrally, and the spirit rises to the top

Fu nei song jing qi teng ran 腹内松净气腾然

Wei lv zhong zheng shen guan ding 尾闾中正神贯顶

Mind as the commander, qi as the signal flag, and waist as the banner
Xin wei ling qi wei qi yao wei dao 心为令气为旗腰为纛

The Biomechanics of waist power

In generating waist power, the upper body rotates in one direction, and the lower body turns in the opposite direction in mutual support. Where should the division of the rotational motions between the upper and lower body be? If only the shoulder and chest were turning to power the upper body action, the rest of the muscles below would be underutilized, a common flaw. If the division of the rotations occurred at the knees, then the muscle mass below would have to support a much larger mass above, which would cause injuries to the knees or ankles. The division at the kua junction represents the most proportionate distribution of muscle masses between the upper and lower body, which can be seen in the power actions of Fig. 1.



Fig 1 Rotational motions at the waist-groin junction

There is another anatomical factor to waist power. The vertebral column ends at the sacrum which sits on the pelvic (iliac) base at a flat joint, called the *sacral-iliac joint (SIJ)*. The SIJ forms the hub of the transfer of forces between the upper and lower body via the three levers, the spine and the legs through the pelvic platform.²

The hub function of the SIJ has actually been observed in the Taiji classics:

If body cannot maneuver to take timely advantage (*de ji de shi* 得机得势), then the problem is at the waist and legs (*Qi bing bi yu yao tui qiu zhi* 其病必于腰腿求之).

Strength is released from the spine, steps move with body in accord
Li you ji fa bu sui shen huan 力由脊发步随身换

How does the body comprehend force?

Force arises when there is a change in motion. The change in body motion that we have cognition of occurs in two ways. The first is the contractile actions of muscles, which produce body motion. We are not cognitive of the contractile force of the muscles but we have cognition of the motion. The second is the change in body motion wrought by an external agent, for example, when we run into a wall or are hit by a moving object. We have direct cognition of the force that results from this change often from the injuries sustained.

We may associate force with the speed of the fist but we are not conscious of the biceps and triceps contracting and working in antagonistic pairs to produce the motion. But what is the force of the punch? We appreciate the force imparted when a head stands in the way of the fist from the bloodied nose—the impact of the collision. But there would be much less drama if a pillow was struck instead. So the force of a punch is not the same; it depends on what is struck.

The force that the body comprehends is the force that results from a change in its motion, more precisely, its momentum (mass x velocity). This is expressed by Newton's Second Law of Motion:

$$\text{Average Force} = \text{Change in Momentum} / \text{Time duration of the change.}$$

From the Law, the key to producing more force is to generate more momentum by increasing speed and involving more body mass. However, it is complicated in practice as body motion is not uniform. It is a composition of the movements of many segments. The issues of generating greater momentum involve:

- The body segments moving coherently in unison
- The alignment of muscle actions
- The spinal rotation due to torsion by the Spinal Engine
- The harmony of the fascial envelopes of muscles and internal organs

The force that we produce—that which arises from the change in momentum—would be maximal if the internal momentum of the body is harmonized. That is, generating strength is very much about regulating to harmonize body motion, not just about increasing body or muscle mass.

Here we study the movements of body segments and the alignment of muscle actions in generating momentum, but mention only in passing the other two factors, which will be topics of another paper.³

Inner Balance

Taijiquan's game plan to generate greater momentum is to regulate the body segments to move in unison. The traditional theory couches this in the principle of harmony and articulates that the art be in accord with the Taiji principles of yin and yang, the main one of which is yin-yang balance or harmony. This yin-yang harmony pervades every thing Chinese—in food, arts, music, fengshui, etc. In Traditional Chinese Medicine (TCM) health is a good store of the life-force energy, Qi, circulating in harmony.

The modus operandi of Taijiquan is to incorporate qi in the application of the yin-yang metaphysics to the art of body motion. But there is no quantitative analysis in Taiji theory to tell us what is the balance of yin and yang. However, in the manifestation of yin and yang we can develop cognition of excesses or deficiencies of yin or yang, and hence of yin-yang imbalance. In the musculoskeletal framework, we learn to discern yin-yang imbalances as excesses or deficiencies of muscle actions underlying body posture and motion.

In other words, the meat lies in the muscle actions underlying body motion and posture. We thus study muscle actions and qi dynamics and seek harmony between them in the context of generating dang-yao jin (waist power) to find and comprehend neijin.

In this paper, we refer to the yin-yang balance of Taijiquan as **inner balance**, which is a state where the muscle actions underlying body posture or motion are not excessive or deficient, independent of the loads in the body. Once we have cognition of the errors of muscle actions—excessive or deficient—we can work to resolve them towards a better state of balance. But, even as this points to a pragmatic approach, we encounter the practical problem of resolving imbalance. We cannot allocate so much muscle actions here and so much there to resolve the imbalance as in a scale balance nor are we cognitive of the muscle actions directly.

However, we can cultivate cognition and sensations of the effects of the errors of muscle actions. An instance of this is illustrated in a medical checkup where the doctor puts a stethoscope on your chest and asks that you breathe in. In doing so, the chest is heaved up, and the body becomes top-heavy, which falls easily with a gentle nudge. While the body is in physical balance, the abdomen is hollowed, weakening the support column of the midsection internally, and rendering the structure less strong in balance. The body can learn from the top-heaviness as an effect of yin-yang imbalance of muscle actions.

We commonly introduce internal imbalances in the body structure in routine actions, such as when we raise a hand high up excitedly to attract attention. There are many varying combinations of muscle actions underlying a body posture and motion. For mundane activities the differences of the support do not matter much, but in sports they determine the performance outcome. What should be the preferred combinations of muscle actions for a given body posture or motion? Taijiquan's answer is inner balance, namely, those combinations of muscle actions with lesser errors.

So training in Taijiquan is all about regulating body motion to harmonize the muscle actions to cultivate inner balance. The immediate import is a consolidation of the body's physical balance. By reducing the errors, the muscle actions become better aligned and balanced, and thus the body's internal momentum becomes more harmonized. As we shall see, in the course of training, qi is also developed. Think of the prize of inner balance: The force that ensues in any action is maximal and balance remains intact. However, the practical problem of resolving the muscle actions that we have no cognition of still remains. How do we get the body to listen?

Responses of neurobiology

The responses of neurobiology work very well for our bipedal balance and functionality, but not so when we need to summon the muscles necessary to power performance actions in sports. Golfers have the comparable muscle masses to deliver long drives, but train as hard as they do, few amateur players can improve significantly their golf range. We cannot at will elicit neural responses to fire the right combination of muscles and we actually do not know which muscles to recruit.

The body is stubborn in its neural responses to recruit muscles, out of habits and convenience, which can bring harm to the body. For example, in picking up a box, the hands reach out and the body leans forward. The back muscles fire by reflex to keep the body from falling over in the leaning posture. In lifting the box, the weight pulls the body further down, requiring more muscle actions to keep balance. As a result, much of the muscle power goes to the reflex response to keep balance, and less to do the task at hand. There is no feedback of the debilitating effects of the muscle actions with regard to bad postures that can cause chronic backaches. One could move closer to the box, squat down to lift the box with better leverage with the aid of the leg muscles. The body can learn and incorporate from the discomfort of the strain as a feedback of postural effects due to muscle actions.

Similarly, in throwing a punch, the muscles closer to the fist tend to dominate. This dominance causes the arm to lunge forward ahead of the rest of the body, cutting the muscle power of the rest of the body to the punch. The body again can learn to sense and associate the inadequacy of the punch due to the poor alignment of the muscle actions.

Although we are presumed to have control of the voluntary movements in the somatic nervous system, we have no direct control—we have no communication with the muscles. The control we have is only at the command level, at the top hierarchy of the motor system. For instance, we have control at the command level, to touch the nose or ear, but we have no cognition of the multitude of neural activities in feedback and signal between the command and the innervation of the complex of muscles that result in the action.

There is a huge gap of neural activities between the command and the innervation of muscles that produce the motion at the bottom hierarchy. Training is at the mercy of this gap of neurobiology that we have no cognition of.⁴ What sensory feedback data can we rely on in this gap to guide a preferred combination of muscle actions of the command?

To overcome this problem, Taijiquan resorts to the yin-yang theory to cultivate qi to bridge this gap via the *yi-qi-motion* paradigm:

Yi dao qi dao qi dao shen dong 意到气到气到身动
Command arrives and activates qi; qi arrives and activates motion.

In the response to the yi (mind) command at the top hierarchy, Taiji uses qi, developed in the training, to signal and guide the activation of muscles underlying the action or motion commanded. In other words, qi energy conveys the command to the muscle innervations that result in the motion (*yi qi yun zhen* 以气运身), and to receive feedback data of the action. This signaling and sensory role of qi is developed by relating the nurturing of qi with the underlying muscle actions as they are being resolved towards inner balance, which is discussed next.

Fangsong and Qi

Although we take *Qi* 气, the life-force energy, as given in Traditional Chinese Medicine (TCM), we can think of it as a composite of bioenergy, any energy involved in biological functions and processes. The bioenergy becomes interesting when it is accessible and is associated with some biomarkers. We rely on biomarkers to discern energy levels. For instance, hunger is a biomarker associated with low food fuel, cold with negative temperature gradient, pain with bodily harm and damage, etc. while emotions are more complicated, triggered by a torrent of neural signals and hormonal changes.

Thanks to the pioneering work of Shin Lin and his research team, we can identify some bioenergy as surrogates of qi. They have quantified increases in the following physiological and bioenergetic changes due to Taijiquan or qi-energetic exercises: a) blood flow (perfusion), b) state of relaxation as indicated by heart-rate variability and brain-wave analysis, and c) bioenergy emission in the form of heat, light (photon counts), electrical charge, and conductance at acupuncture points.⁵

The first sensation of Taijiquan or qi-energetics exercise most commonly felt is tingling and warmth in the hands, due to increased blood flow or perfusion. However, Taijiquan relies more on changes in bioenergy associated with the balance and alignment of muscle actions in the cultivation of inner balance. The initial sense of muscle actions is derived from their internal imbalances, which give rise to the experience of discomfort of tenseness or unease of motion.

To illustrate this imbalance at a basic level, extend an arm out and hold it in balance. The arm is in physical balance but the muscle actions supporting it can vary, for instance, when held stretched out or let to droop. Holding the arm up for ten minutes, tenseness and aches in the muscles would set in, which indicates excessiveness in some muscle actions. Upon sensing the discomfort, a symptom of the internal imbalance, the body triggers a reflex response of relaxation, which brings some relief.

This response is called *fangsong*, which is “to relax and let go.” The reflex response, operationally, is a reset of the muscle activations, which improves the state of support with

less discomfort. The resettling of the muscle actions into another combination lessens the tenseness, and this is accompanied by an ease of flow of motion, which sensation is a biomarker of qi energy. The function of relaxation represents the rudiments of the tool, which we also call *fangsong* 放松 that reduces the errors of internal imbalance of the muscle actions. In other words, the fangsong resolution that reduces the errors of muscles actions equates to qi energy—the more the errors are reduced by fangsong, the more the qi.

The qi sensation is due primarily to a coherence of bioenergy in a better state of balance of muscle actions, derived from the lessening of tenseness or stiffness, the ease of motion flow and transmission at the joints. These are mostly the somatosensory data from receptors in ligaments, tendons, muscles, as well as pressure and temperature of movements (kinesthesia) and receptors of position in space and of balance (proprioception).

Taijiquan practice, motivated by dang-yao jin, is primarily concerned with the problem of inner imbalance of the axial motion of the spine and the appendicular motion of the limbs, namely, the errors of excessive or deficient muscle actions of the core axial muscles and the appendicular muscles. At the joints, the concern is with inner balance between the actions of the inner muscles that secure and stabilize the structure and the outer or prime-moving muscles that move the segments.

We respond quite readily with movements of the arms and legs, but are not very aware of the core axial movements in the spine. We are not very clear of the muscle actions at the joints—the internal movements. The prime-moving appendicular and outer muscles tend to dominate in actions. This is the main cause of the errors of the excessive or deficient muscle activations at issue in inner balance, which confounds training in art of body motion.

The slow-motion and deliberative fangsong methodology works to rein in the dominant muscle actions, and allows the lesser muscles to activate more so that they can align better in the action. This gives more balance and induces more optimal muscle activations at higher levels, which leads to more coherent bioenergy. The higher activation levels of the muscles are often experienced as a surge of heat in practice. The body experiences the elevated bioenergy as qi energy, and learns to associate the qi biomarker with the better balance and alignment of muscle actions. This association in time grows the qi as a marker to regulate motion of inner balance.

In the stepping movements of Taijiquan practice the body settles stably in the substantial foot as it steps forward. One can see that compared to walking, the muscles are working at a higher level of activation in the weighing of the body in the solid foot and the slow pushing of the body forward. Indeed, the increase in the bioenergy is confirmed by Shin Lin and his research team who have measured that in Taijiquan play, the activation level of the quadriceps muscles of the upper leg is raised 2 to 4 times more than walking.⁶

To recapitulate, fangsong works in a passive mode—it resettles the muscle actions so that the outer muscles that move body segments become better aligned and balanced with the inner muscles that secure and stabilize the joints and structure. In this way, the errors of muscle actions that are too yang (excessiveness) or too yin (deficiency) are reduced and in conjunction, qi is cultivated under the varying load conditions of the body. The thrust here is

that the qi energy thus developed is a biomarker associated with the fangsong resolution of muscle actions to seek inner balance. The key point that cannot be overemphasized is that the qi in time evolves as a marker used to regulate Taijiquan motion in the yi-qi-motion paradigm.

The Tao of fangsong

The fangsong tool can only be applied to discern imbalance and to reduce the errors of excessive or deficient yin or yang. The soft yin-yang logic does not lend to reductionism that offers quantitative measures of values in balance. How does one ensure that the fangsong process leads to a path of convergence to inner balance?

Two crucial factors of fangsong must be developed to lead to convergence. One, fangsong is an organic tool that must be refined continually to penetrate the ever deeper vestiges of the errors of muscle actions. And two, the attentiveness to the practice must develop as meditation to inspire the increasing concentration needed in the fangsong operation. The meditative component becomes more important as the practice advances and its development is necessary to sharpen and refine the fangsong tool.⁷

Taijiquan is far easier in practice than in theory. You simply apply fangsong to resolve imbalance as it is perceived. The methodology only requires that you stay in the middle ground between not too yin and not too yang. For that, you have to be constantly mindful and attentive, so that you are aware of the errors and their resolution by fangsong with the concomitant qi.

In practice the theory unfolds thus: At the advanced stages, when qi is sufficiently developed, the fangsong tool relies more on qi as a medium to discern and resolve the imbalances. Gradually the qi is used to modulate motion. The stronger qi becomes an indicator of more aligned and balanced muscle activations. The recipe of attentive meditation is the refining of the fangsong tool to get at the subtler errors. In this way, by staying in the “middle ground,” as the margin of errors tapers under the ever sharpening fangsong tool, the path eventually converges to inner balance. This represents the quintessence of the Tao of “doing without doing” (*wei wu wei* 为无为).

In the meanwhile the yi-qi-motion paradigm is realized in the maturity of qi development: The yi-command stirs the qi; the qi dynamics drives the motion, forging the unity of qi dynamics (internal) and motion (external). This represents the unity of the internal and external—*nei wai jie he* 内外结合. In this way, the yi-command at the top hierarchy transmits via qi to muscle innervation at the bottom hierarchy in the discipline of Taiji motion.

The Kua Junction and Dantian Centrality

The hard part really is not the science, but the training to deliver the goods of neijin. We have “hundreds of joints” and checking through the imbalances at each one of them is clearly a formidable undertaking, but what makes it even more formidable is that resolving the errors at one joint requires recalibration at the other joints because of the tensile integrity of the body

frame.

Ironically, while the problem is one of systems science, we again find a practical solution in the same traditional theory of yin and yang and qi. Guided by the Principle of Three Sections and the Principle of Three Harmonies,⁸ the complex of joints are divided into sections or correspondences of three for the fangsong resolution to work through systematically, and then through further subdivisions in refinement. But more than a scheme of simplification, the principles guide the transmission of motion through the joints and build the harmony of the correspondences of joints.

For instance, the fangsong in the correspondence of the shoulder and kua aligns and balances the torso, which harmonizes its internal motion and momentum. In the three-section classification, the leading direction of the hand (as the extremity section) induces the driving force at the shoulder (as the root section), to transmit smoothly and timely through the elbow (the middle section). The theories are embodied in the *Ten Essential Principles of Taijiquan* by Chen Changxin (1771-1853), the 14th Generation Patriarch of the Chen Family Taijiquan, and are discussed in the author's book.⁹

In essence, the principles reduce the issues of the myriad joints to the kua junction serving as a base of reference in the fangsong resolution. This reinforces the eminent status of the kua junction as the division between the upper and lower body in generating waist-groin power, discussed earlier. In practice, it means that the fangsong resolution involves a continual play of muscle actions of the pelvic platform and of the SIJ and the hip joints (Fig 2).

More importantly, the constant reference to the kua is nurturing a centrality of motion at the midpoint of the junction. This midpoint coincides functionally with the *dantian* (丹田) location, which is also at the same level of the SIJ. The centrality of the dantian affirms the SIJ as the hub of the transfer of forces between the three levers, the spine of the upper-body and the legs of the lower body.

From the qi perspective, the referencing to the dantian in fangsong creates a qi connectivity between the joint and the dantian, and thus a web of qi connectivity centered at the dantian. The upper limb movement is always qi-connected through the dantian to the legs anchoring on the ground via a path of qi dynamics.

In other words, the fangsong resolution is cultivating qi that accentuates the centrality of the dantian—filling up the lower abdomen with qi and concentrating at the dantian, which is called *dantian qi*. Thus, the practice of fangsong of the myriad joints to attain inner balance is reduced to cultivating the fullness of dantian qi to establish the centrality of the dantian.¹⁰

The fullness of dantian qi signifies that the central status of the dantian is formed (*yi dantian wei hexin xing cheng* 以丹田为核心形成) and represents the mastery of the art. The establishment of dantian centrality means that in the yi-qi-motion paradigm, the guiding qi is the dantian qi. This brings to fruition the central control at the dantian and inner balance is achieved. Qi dynamics and motion—internal and external—are unified in accord with the Taiji principles. Neijin is born of this motion.

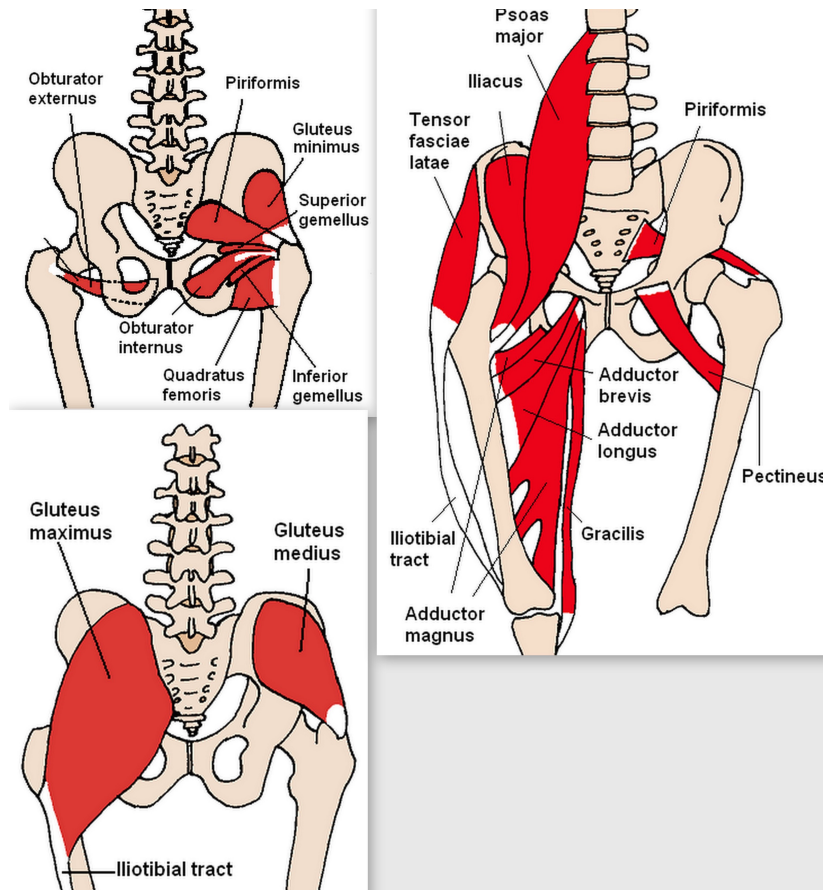


Fig 2. The muscles of the pelvic platform and the three levers

Explosive Release of Energy—*Fajin* 发劲

A most illustrative manifestation of nei jin is the *fajin* action. *Fajin* is an explosive release of energy in an action. When the entire body's energy is harmonized and directed in the release, the power of the *fajin* is mesmerizing and never fails to impress. The crisp power of Chen Xiaowang's signature *fajin* is captured in the video clip in the link, where we can also see the unison of body motion and the unified momentum of the actions (<https://www.youtube.com/watch?v=5LosS2vjmek>).

Let us revisit the biomechanics of dang-yao jin (waist-groin power) to review nei jin in the *fajin* of a punch. The two crucial factors in the execution are: 1) the mutual support between the upper and lower body motion and 2) the body's rotational motion, and they are integrated in the action. In a right-handed action, the torso is rotating to the left at the waist or kua junction, while the base of the legs is turning to the right below to produce the torque action and reaction in mutual support and balance.

The mechanics of rotating the torso at the spinal axis seems easy enough, but the torso is not a simple solid piece. Structurally, the torso consists of the top-heavy ribcage hanging on the upper vertebral column, which lower end sits precariously at the pivot of the sacrum. The structure fits perfectly in the musculoskeletal framework, but it is inherently unstable. Unsound

as the skeletal structure may be, dressed up in muscles, it is an engineering marvel that gives us our remarkable bipedal functionality and balance. Nevertheless, it is not easy to exploit the engineering to deliver the power of *neijin*.

In generating waist power, we want the torso to move as one unit, but often the left and right sides of the body do not turn in sync. For instance, in the anxiety to be quick, the right side tends to dominate in a right-hand punch, which causes a drag on the left part of the body. Golf prescribes a simple exercise: turning the body with a broomstick held against the back by both elbows, which trains the left and right sides to move in sync in the swing.

We also want the torso to turn at the waist, but we are conditioned by our walking gait to turn the upper body at the chest level (at or below the T12/L1 vertebrae). This would deprive the torso of the momentum of the muscle mass of the midsection. The rotational problem is compounded by the torsion introduced in the spine by side flexion due to the spinal curvatures.¹¹ The martial arts practice of stationary horse stance is a basic training to settle the torso into the pelvic joints. Throwing a punch thousands of times and standing stationary in a horse stance in the years of kungfu training are to connect the shoulder and kua to turn as a unit in motion, thus packing the punch in more unified momentum.

These issues are addressed by Taijiquan's cultivation of inner balance. The *fangsong* applied to the shoulder-kua correspondence works to balance and align the many muscles of the torso (the lats, gluts, pecs, deltoids, traps, et al.) with the core axial muscles that maintain the integrity of the spine. The discipline of inner balance unifies the internal movements of the torso, thus its internal momentum.

The practical import of the continual *fangsong* play of the kua to establish dantian centrality is to facilitate the ease of motion and force transfer at the SIJ hub and hip-joints via the pelvic platform. This translates to the ease of maneuvering and turning at the kua to express *dang-yao jin* (waist-groin power).

The principle of inner balance is indeed comprehensive: It endows integrity of structure and balance and alignment of muscle actions at the joints. Driven by the dynamics of dantian *qi*, the internal movements of the segments are forged in unity. With the principle of harmony, the internal motion flows smoothly through the body unforced, with no obstruction or resistance; the left and right are balanced and the upper and lower body in mutual support. This harmony is the fruition of the internal dimension of the Principle of Three Harmonies: the harmony of the heart (*xin* 心) and mind (*yi* 意), physical force (*li* 力) and *qi* (*qi* 气), and tendons-muscles (*jin* 筋) and bones (*gu* 骨).

When motion regulated by inner balance is accelerated, what ensues is a refined and cultured expression of force that is explosive—frightening and graceful at the same time. Guided at the dantian hub, the issuance of *fajin* flows forth balanced and unforced, so appears effortless with no visible exertion. Grounded on inner balance every muscle fiber and sinew are aligned in the *fajin* action. Not wanting in balance, the full potential of the body's energy is directed at the action, so that the *fajin* power delivered is consummate.

Actually, fajin is simply an action like stepping on the gas pedal to speed up the motion. However, if the body is not Taiji regulated, it would be like a car not in tune, wheels unaligned, and tires uneven, sputtering off the road. The body imbued with inner balance is like a whip, which transmits motion with no resistance. The fajin motion transmits through the body and emanates at the extremity like the crack of a whip, with the silk garment snapping crisply on the body.

The fajin action manifests the *gang* (hardness) character of neijin, where the limbs and body are summoned to move in harmony, including the internal motion of the organs, tissues and fascia, thus bringing all the momenta to bear in unison. There is an opposite, the *rou* (softness) of neijin, which characterizes the ease of change of the internal movements of the body, thus the liveliness of maneuverability.

The *Rou* (Soft) and *Gang* (Hard) of *Neijin*

The reason why the traditional Taiji theory works in the science of body motion is that the body responds to the organic logic of yin and yang. This will become clear when we see how the body relies on the yin-yang duality to access the force of neijin.

In physics, force is a vector with two components, magnitude and direction. Our neurobiology sees and responds to force not in quantitative but relative terms. The body does not produce force to match a vector with desired magnitude and direction, but responds with force as needed in interactions. For instance, when pushed in a tussle, we respond instinctively by pushing back to prevent from being shoved off and to fight back. However, this relies only on one component of the force, namely, its magnitude. And we know well that in a contest of strength, the stronger force would prevail in a linear dimension. The “natural” response of pushing back would be a poor strategy for a person of weaker disposition. We can mitigate the force's impact if we can maneuver the body to absorb and receive the incoming force at an oblique angle. Also, once the muscle activations are committed in the response, the body tends to be locked in the posture, rendering it unable to change.

Neijin responds with soft (*rou* 柔) and hard (*gang* 刚) to result in the right force vector to counter the attacking force. The *rou* response allows the body to adjust internally to absorb and thus withstand the force at a reduced magnitude of impact. The maneuver uses the lively (*linghuo* 灵活) path of qi-connectivity centered at the dantian to do so, which is accorded by the Principle of Dantan Centrality. This is the skill of “using softness to overcome hard power” (*yi rou ke gang* 以柔克刚).

Neijin's strategy is to use the *rou* response to let the opponent's aggressive force be spent, and then follow with the *gang* response to repel the attack with the formidable force that flows from harmonized internal momentum. In the *rou* response, there must be sufficient *gang* to support it, otherwise one would have been shoved off before any technique could come into play, and in the *gang* response, there must be *rou* to maneuver in appropriate changes to the load on the body. Most crucial of all, the principle of inner balance accords maneuverability in the instantaneous change between *rou* and *gang*, and maintains balance at all times.

The classic and oft touted kungfu skills of Taijiquan:¹²

“Four ounces repel a thousand pounds” *Si liang bo qian jin* 四两拨千斤

“Lead opponent's force to emptiness” *Yin jin luo kong* 引劲落空

“Borrow force to strike back” *Jie li lai da ren*, 借力来打人

and the *qinna* joint-locking skills, all rely on the liveliness of the change of *rou* and *gang* of neijin in the application. In short, the magic of the consummate force of neijin lies in the response of the right measures of *rou* and *gang* that imparts the *rou* liveliness in the interchange, and the *gang* explosiveness of power in the unified momentum.

The Triple Gems

The achievement of Taiji balance does not just bestow just one gem, but the triple gems:

- Neijin
- Equanimity
- Homeostasis

When you attain inner balance in Taijiquan training, you are rewarded with neijin and all the kungfu skills that flow from it. But the prize is far greater. You gain bliss and tranquility of mind, and something else, you also get the package that provides health and wellbeing, namely, the homeostasis of the biological and physiological environment of the body.

Although we have mentioned meditation only briefly, in Taijiquan practice, its development is complementary. Fangsong resolution requires constant attentiveness to the process, which is the mind aspect of the practice. It has the effect of restraining the restlessness of the “monkey mind,” and thus quieting the mind. Calmness is conducive for the mind to stay focused, which reinforces attentiveness that further cultivates awareness and concentration. The discipline builds a sea of tranquility in the mind and one enjoys bliss and equanimity. More of meditation and Taijiquan can be found in author's book.¹³

In TCM, qi and blood are inextricably intertwined in concept and function. Sometimes blood is described as a denser form of qi. TCM sums it up thus:

Qi is the commander of blood
Blood is the mother of qi.

In this qi-blood inseparability, TCM's central tenet of qi as the life-force energy that gives life and vitality in biology is easy to appreciate as blood circulating the body delivering oxygen, nutrients, ions and hormones.

The principle of qi-blood inseparability is also supported by Shin Lin's research which finds evidence that not only are blood flow and electricity increased but that the increases are coordinated in Taijiquan and qigong,¹⁴ as well as in other Chinese therapies such as acupuncture, massage, and topical herbal remedies.¹⁵

Thus, by TCM's qi-blood theory, the fullness of qi developed in inner balance inures to the blood in all its optimality to benefit the body's biology. In other words, inner balance delivers the full package of homeostasis to every system of the body's physiological environment. Also Taijiquan's deliberative slow motion in fangsong supports the transport of lymph up the body in the circulation of the lymphatic system. The fangsong and muscle activations provide a coherence of pressure at the lymph nodes, particularly at the feet and at the inguinal fold where there is a concentration of.

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(<http://www.amazon.com/Taijiquan-Cultivating-Strength-C-P-Ong/dp/061587407X>)

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Recent Publications:

Generating Inner Strength Through Taijiquan, Int J Complement Alt Med 2016, 3(3): 00076

(<http://medcraveonline.com/IJCAM/IJCAM-03-00076.pdf>)

The Central Status of the Dantian, Cover Feature, Tai Chi Magazine, Spring 2016.

- 1 The five classics are: *Taijiquan Treatise* (attributed to Zhang Sanfeng), *Taijiquan Classiscs* (by Wang Zongyue), *Thirteen Postures* (Anonymous), *Elucidation of the Thirteen Postures* (by Wu Yuxiang) and *Song of Push-hands* (Anonymous).
- 2 A Vleeming, et al. *The sacroiliac joint: an overview of its anatomy, function and potential clinical implications* J Anat. 2012 Dec; 221(6): 537–567. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3512279/>
- 3 C.P. Ong. (Draft) *The Spinal Engine and Taijiquan*.
- 4 C.P. Ong. *Generating Inner Strength Through Taijiquan*, Int J Complement Alt Med 2016, 3(3): 00076. More discussion of neurobiology in this paper. <http://medcraveonline.com/IJCAM/IJCAM-03-00076.pdf>
- 5 Shin Lin. *Research Leading to Systems/Cellular/Molecular Model for the Benefits of Qigong and Tai Chi on Health and Healing*. Theses: Scientific and Skill Papers on Qigong, published in coordination with The World Qigong Forum 2007 and 10th World Congress on Qigong and Chinese Medicine, Tokyo, 2007. pp. 3-8.
- 6 Shin Lin, et al. *Electromyographic study on Tai Chi's activation of muscles essential for fall prevention and weightlifting*. J. Altern, Complement. Med. 19: A49 (2013). <http://online.liebertpub.com/doi/pdfplus/10.1089/acm.2013.1502a>
- 7 C.P. Ong (2013). *Taijiquan, Cultivating Inner Strength*. Bagua Press. More of meditation is discussed in Chap 10, p. 257.
- 8 This consists of Three External and Three Internal, making it the *Six Harmonies*, as it is also known.
- 9 Ibid 7. The principles are discussed in Chap 7.
- 10 C.P. Ong. *The Central Status of the Dantian*. Tai Chi Magazine. Spring 2016.
- 11 Ibid 3. Gracovetsky's Spinal Engine Theory.
- 12 Ibid 4. Discussed in the Section: *The Physics of the Prowess of Neijin* and also in author's book.
- 13 Ibid 7.
- 14 Lin et al.: *P01.29. Pre-polarization conductance at Jing-Well acupoints on the hand is correlated with blood flow measured by laser doppler flowmetry*. BMC Complementary and Alternative Medicine 2012 12(Suppl 1):P29.
- 15 Lin et al.: *P01.05. Increase in blood flow associated with traditional chinese medicine therapies*. BMC Complementary and Alternative Medicine 2012 12(Suppl 1):P5.