

Chan Ding for Autism Prevention — Hypothesis of Brain Plasticity by Tri-Mailuns Activation

Pei-Chen Lo, Ming-Liang Huang, Jung-Cheng Chen

Abstract—ASD (autism spectrum disorder) prevalence has doubled in Taiwan since 2007. Like those with depression and stress syndrome, more autism individuals seek solution in heart-to-heart imprint sealing (HHIS) Chan Ding. HHIS Chan Ding, the unique practice of orthodox Chan Buddhism, has aroused more attention since 1990s due to its preventive capability and therapeutic effect explored in mailuns activation. In recent years, more successful cases demonstrate the positive effects of Chan Ding on ASD individuals. This paper mainly reports 1) the hypothesis for preventing ASD prevalence by HHIS Chan Ding, and 2) the results of ASQ (Autism Screening Questionnaire) survey on Chan-Ding and control volunteers. The effectiveness of Chan Ding on reducing ASD prevalence is hypothesized by 1) the optimal Yin-Yang balance (Tai-Ji) and WuXing efficiency of meridian networks driven by mailuns, in accordance with the principles in traditional Chinese medicine (TCM), and 2) the unique neuroplasticity for realizing the new body-mind-spirit interfacing with detached brain dominated by true heart. The essential mechanism involves the brain reformation by tri-mailuns activation in Chan Ding that rewires the entire neural network. Meridian-energy results exhibit significant enhancement of Yin-Yang balance and WuXing efficiency after Chan Ding. ASQ statistics reveal prominent benefit of leg-crossing posture.

Index Terms—Autism spectrum disorder (ASD), Brain plasticity, Chan-Buddhist Chan Ding, Yin-Yang balance.

I. INTRODUCTION

Toddlers and adolescence exhibiting ASD traits are found to increase in Taiwan in recent years. Due to lack of background knowledge of autism, most parents are unaware of children's symptoms such as the hindrance to communication and socialization with peers, abnormally repetitive activities, resistance to environmental change, or unusual responses to sensory experiences. These symptoms are often considered as the naughty, flattering behaviors to arouse parents' attention until finding their aggressive and violent behaviors against peers. The Ministry of the Interior announces 170% of the increase in autism prevalence from 2002 to 2012. Sun et al. reported their estimate of pooled prevalence of 26.6 per 10,000 individuals, with 95% CI (confidence interval) range of 18.5 – 34.6 in mainland China, Hong Kong and Taiwan [1]. A recent survey reported approximately 2 – 4 students in a class were identified with autism [2], with urban schools twice likely to identify students with autism than rural schools. It is widely acknowledged that genetic factors play a major role in ASD [3]. Environmental factors are the other possible cause speculated mostly by researchers.

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Fetal and infant exposed to pesticides, viruses, and household chemicals might suffer neurological disorder with various ASD symptoms in the outward behavior [3]-[5]. Studies of people with ASD have found irregularities in several regions of the brain. Children with ASD were found to have significantly increased cerebral volumes and amygdala enlargement [6]. Disorders of brain-neural network development result in impairments in communication and social interaction, inattention to ongoing events, repetitive thoughts and behaviors. At present, both cause and solution for ASD are uncertain still. Traditional Chinese Medicine (TCM) became relatively appealing to Western medical specialists in recent decades [7]. According to the principles of TCM, functions of the brain are mainly dominated by *Shen*, the spiritual entity of the heart, in the promotion cycle of five Zangorgans (liver → heart → spleen → lung → kidney, called WuXing, or five-element theory) for maintaining Yin-Yang balance. Purity of *Shen* yields tranquil, clear mind with best mindfulness and creativity. Yin-Yang balance and WuXing promotion are the most fundamental concepts in TCM operation. Major ASD symptoms like the deficiencies on mind reasoning and awareness provide the guideline of diagnosing the Yin-Yang imbalance of heart, spleen and kidney (Traditional Chinese Medicine, <http://www.shen-nong.com/eng/front/index.html>). Therefore, the treatment of ASD considered as systematic disease in TCM would be focused on the balance of Yin-Yang energy of Zang-organ functional interactions. Conventional ASD treatments include the treatment of autism's core symptoms mostly by behavioral intervention therapy and the treatment of associated medical conditions that may involve medications [8]-[10] and other medical management [11]-[15]. Spooen et al. reports the insight into the neurobiology of ASDs and the potential development on medication for autism [8]. Posey et al. [10] reviewed the important studies published on the rationale use of the antipsychotics drug class. The behavioral intervention focuses on social skills, language and communication, imitation, play skills, daily living and motor skills. A well-developed treatment, TEACCH (Treatment and Education of Autistic and Communication handicapped Children), has also been applied to autism treatment in Taiwan. Due to the undesirable side effects in conventional medication and medical management, complementary and alternative medicine (CAM) becomes plausible and have been extensively adopted since 1990s [16]-[20]. Perrin et al. discusses the possibility of treating co-existing conditions by using CAM along with other medical care [17]. It reports that ASD children use more CAM when they have co-existing gastrointestinal symptoms, seizure disorders, and behavior problems. In TCM, acupuncture therapy for Yin-Yang balance has been suggested to treat autism children and proved to be relatively effective in improving autistic syndromes. Paper [21] reported that acupuncture-treated

groups had a superior improvement over behavioral therapy-treated groups, Chinese herbal treatment groups, music treatment, or Chinese massage treatment groups. Among CAM approaches, meditation based on mind-body interventions has been introduced to ASD treatments [16], [19], [20]. Singh et al. demonstrated the effectiveness of mindfulness meditation in helping three autistic adolescents to manage their physical aggression over several years [16]. Sequeira and Ahmed [19] reported the greater relaxation and facilitated expression of feelings by practicing yogic meditation. Paper [20] proposed that the mothers' mindful parenting decreased their children's aggression, noncompliance, and self-injury. Mindfulness-based (MbM) and transcendental meditation (TM) techniques are widely practiced in Western countries. TM focuses on an image, song, mantra, or breathing to enhance mind-body coordination. MbM mainly makes awareness about the present thoughts. Both meditation schemes involve the brain-mind operations. HHIS Chan Ding transcends the physical world and time-space realm to attain the pure light of eternal wisdom (Chan). Consequently, practitioners need to become *detached* with the heart and mind extremely calm and still like a wall, preached by Chan patriarch Bodhidharma (Appendix I). HHIS Chan Ding induces a totally spiritual, heart-purification journey towards the disclosure of *true nature* inside the heart (Appendix I). Differing from the mind-body intervention in most meditations, Chan Ding is exclusively heart-dominant. The effectiveness of Chan Ding for treating adolescence with ASD or ADHD (attention deficit hyperactivity disorder) has attracted great attention after a number of successful cases were reported in recent years. The very essence of its effectiveness can be explained by 1) persistent brain plasticity by tri-mailuns Chan Ding, and 2) heart-purification Chan Ding for cultivating Shen, described below.

II. HYPOTHESIS—BRAIN PLASTICITY THROUGH CHAN DING ENHANCING FIVE ZANG-ORGANS BALANCE

Since 1990s, more high-tech engineers in Taiwan suffering the stress-induced anxiety or depression disorders have found Chan Ding to be effective in treating their problems. Approximate 90% beginners are able to experience more gratitude and contentment in everyday life after three-month Chan-Ding practice at Chan centers. After twelve-hour intense work during the day, they are able to rapidly restore and power up their brain by immersing their jammed and stuffed brain in the light at Chan center. Brain as an extremely complicated and delicate system, has never been explored to the most of its potency. These high-tech practitioners have recognized the best approach for making the most of our brain and mind is to first empty and free them through true Chan Ding. Our previous studies corroborate that Chan Ding makes lasting beneficial changes in the brain and mind, including the positive emotions, better stress manipulation, sustaining mindfulness attention, and noticeable anxiety/depression relief [22]-[26]. According to their narratives, light of *true nature* inside the heart acts as the crucial role. Practitioners disclose the light of Chan as the invaluable remedy for revitalizing the body, cleansing the mind, and purifying the spirit. [26] reported the alpha-

blocking phenomenon during Chan Ding while perceiving the inner light. Most recent study [27] probes the potential of optogenetic techniques for treating depression problems by clearing or altering bad memories. In fact, many HHIS Chan-Ding practitioners, via ten-mailuns activation, have discovered spiritual light deeply inside the heart and are implementing such light in optimizing physical and mental health. They can efficiently employ *mailun therapy* in health maintenance and even treatment for some chronic diseases. Reformation of brain functioning disclosed by practitioners includes photosynthesis, photoelectric conversion, and natural endoscope [28]-[29]. Brain can be reformed by neuroplasticity. However, the resulted neural connections can be upgraded or downgraded. The core issue involves 1) what is the best brain model, and 2) how to rewire the brain neuronal networks to realize it. *Diamond Sutra*, esteemed as the guideline for Chan-Ding practice, provides the most advanced brain-neuronal science that explores an innovative blueprint for a healthy and blissful brain wiring, not to mention solving the ASD problem. The essential property of such a brain is its *detachment* to input stimuli from all sensory organs and liberation of the mind from all thoughts and consciousness, a cleansed and tranquil mind. HHIS Chan Ding is the unique scheme for realizing the brain advocated by *Diamond Sutra*. In TCM, treatment is aimed at restoring the normal balance of Yin and Yang energy (qi) circulating in the meridian networks and Zang-Fu organs. Tai-Ji state characterizes the supreme state of Yin-Yang interactions. Tai-Ji is hardly attainable due to the extreme difficulty of maintaining dynamical equilibrium in physical realm in all aspects. While on the path to the righteous (the third) stage of HHIS Chan Ding [29], practitioners disclose the ultimate Yin-Yang balance of Tai-Ji through the mailuns governing of the meridian system. Accomplishment of the detached brain requires not only the Yin-Yang balance but the Yin-Yang unification inside the heart, called Wu-Ji (neutrality, initial quiescence or emptiness). The following results demonstrate the improvement of Yin-Yang balance and WuXing efficiency after a short Chan Ding.

III. METHODS AND RESULTS

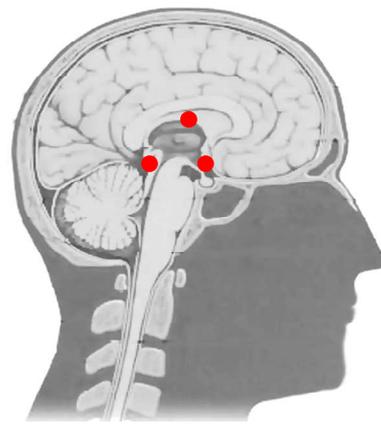
Experiment and Results of Meridian Energy Analysis

MEAD (Meridian Energy Analysis Device) manufactured by Medpex Enterprises Ltd. in Taiwan was employed in the evaluation of the Yin-Yang balance of 12 meridian channels. Skin conductivities of twenty-four acupoints, laterally symmetric at four limbs, are measured to evaluate the energies of twelve meridian channels (Appendix II). Table I lists the results of meridian energy ratio evaluated for six Chan-Ding (CD) practitioners before and after Chan Ding as well as four control volunteers (CN), without any Chan-Ding experience, before and after a 20-minute rest with eyes closed. Normal range suggested for each ratio is shown within the parentheses. For example, Yin-Yang balance requires Yin-to-Yang ratio $0.82 \leq R_{\text{Yin-Yang}} \leq 1.24$ in equation (A.1). *Balance* is the most important guideline for health maintenance in TCM. Upper-to-lower meridian energy ratio ($R_{\text{U-L}}$) of older people is often higher than the normal range (0.78 – 1.09). Practitioner CD_A (age 60) had the $R_{\text{U-L}}$ reduced from 1.50 to 1.24 after Chan Ding. Young people under high level of stress may also exhibit higher $R_{\text{U-L}}$.

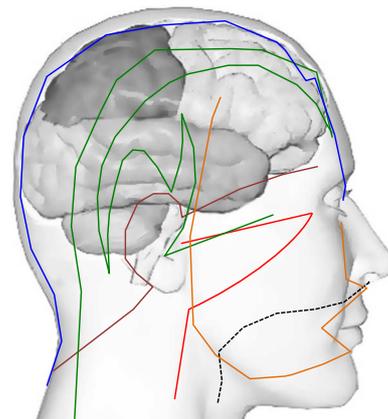
L. Young CD practitioners mostly have lower than 1.0 R_{U-L} ratio, indicating better meridian energy flow at lower limbs. On the other hand, R_{U-L} ratios of non-practitioners (control group) are mostly higher than 1.0, indicating “upper excess and lower deficiency” meridian energy property. Four out of six Chan-Ding practitioners had the Yin-Yang balance improved ($R_{Yin-Yang}$ closer to 1.0) after Chan Ding. In control group, Yin-Yang balance became poorer or did not change after resting. Efficiency of WuXing promotion (E_{WuXing}) in equation (A.3) evaluates the behaviors of harmonious collaboration of five Zang-Fu organs. E_{WuXing} could be restored to healthy state (closer to 5.0) after Chan Ding for most practitioners. Nevertheless, effect of resting on WuXing promotion was trivial for the control volunteers.

Hypothesis — Why Chan Ding may Effectively Treat Autism.

Detachment in Chan Ding is a marvelous state, disclosed by all Chan patriarchs, for temporarily liberating our brain, mind, and heart from all sufferings. Through years of Chan-Ding practice, long-term practitioners can have their brain functioning totally reformed to a detached, heart-dominant brain (Appendix I) that transcends the bind of reward center, stress response, etc. of a normal brain. The *heart* means the purified spiritual entity (true heart, true nature, or true self) deeply inside the organ heart. In TCM, *Jing* (the essence), *Qi* (the life force), and *Shen* (the spirit) are considered as the three treasures, the essential energies, for sustaining human life. TCM views the spirit, Shen, as an integral part of our health and our wellbeing. Cultivation of the spirit is considered essential for health maintenance. Shen actually is the radiance of true nature. In tri-mailuns HHIS Chan Ding, tri-mailuns resonance governs the meridian and neural networks inside the head to reform the brain function. As illustrated in Fig. 1, Yang meridian channels distributed densely in the head are powered by tri-mailuns energy. ChanXin mailun inside the third ventricle creates powerful field to harmonize all neurons in the brain into a tranquil brain that facilitates the WuXing promotion of Yang meridians, Gall-Bladder (wood) → Small-Intestine (fire) → Stomach (earth) → Large-Intestine (metal) → Bladder (water). ZhiHui Mailun at corpora quadrigemina enables the physical body to be in tune with nature (heaven-earth). According to recent progress on cosmology, our physical body or every organism is created and synthesized by trillion of trillion of basic particles, atoms, decomposed from stars and planets annihilated tens of billions of years ago. Hypothetically, we inherit all the macrocosmic properties of the universe. It corroborates the TCM principle of heaven-man-earth unification to disclose the true paradise of compassion and bliss in our heart. HHIS Chan Ding accordingly elicits the egoless love and true peace inside that, in the long run, may create a peaceful world and eventually realize paradise on earth.



(a)



(b)

Fig. 1. Lateral view of (a) the tri mailuns (ChanXin, FaYan, and ZhiHui) and (b) meridian channels including Small-Intestine (red), Triple-Burner (brown), Large-Intestine (dashed black), Gall-Bladder (green), Stomach (orange), and Bladder (blue) meridian.

Qi plays the crucial role for health maintenance. According to *Huang Di Nei Jing*, human life originates at the intercourse of heaven-*qi* (Yang) and earth-*qi* (Yin). Unfortunately, modern people are not aware of the importance of such Yin-Yang unification. Tri-mailuns HHIS Chan Ding helps practitioners successfully connect earth-*qi* to heaven-*qi* and accomplish *Wind-loop* circulation in Chan practice, also well known as “Du-to-Ren connection” in Taoist practice. Du-Ren connection allows heaven-*qi* and earth-*qi* to flow through meridian networks inside human body. In addition, it evokes the intrinsic nature to best harmonize all the physiological and mental functions and slow the aging process. Activation of ZhiHui (Fig. 1(a)) also strengthens pineal body just above corpora quadrigemina. Most importantly, the body-mind-spirit system begins the reformation process.

Table I. Meridian-energy characteristics before and after Chan Ding (eye-closed rest) for Chan practitioners (normal control volunteers).

Volunteer id	Age / years of practice	Yin / Yang energy ratio (0.82 – 1.24)	WuXing efficiency (E_{WuXing})	Upper / Lower energy ratio (0.78 – 1.09)	Average energy (28 – 61)
CD_A	60 / 21	0.62 → 0.87	9.94 → 6.71	1.50 → 1.24	20.63 → 8.89
CD_B	24 / 20	0.98 → 1.18	5.87 → 5.23	1.18 → 1.43	35.51 → 58.30
CD_C	26 / 0.5	1.08 → 0.98	5.47 → 5.02	0.69 → 0.95	87.3 → 87.5
CD_D	45 / 21	0.87 → 1.22	5.05 → 5.30	0.95 → 0.89	75.6 → 88.1
CD_E	26 / 6	0.87 → 1.02	5.05 → 5.10	0.95 → 0.86	75.6 → 76.3
CD_F	25 / 6	1.10 → 1.03	5.65 → 5.48	0.68 → 0.73	82.9 → 73.8
CN_A	24 / 0	1.07 → 0.92	6.22 → 5.21	1.47 → 1.16	67.5 → 46.4
CN_B	24 / 0	1.07 → 1.06	5.29 → 5.28	1.13 → 1.31	80.8 → 85.6
CN_C	23 / 0	1.23 → 1.32	5.08 → 5.12	0.93 → 0.97	97.4 → 79.6
CN_D	24 / 0	0.99 → 1.11	6.47 → 7.63	1.12 → 1.25	87.4 → 95.0

FaYan Mailun at hypothalamus elicits the pure egoless compassion with great bliss so that the reward center is converted into a blissful and compassionate network. Chan Ding with tri-mailuns resonance effectively universalizes all brain neurons to construct a *detached* brain and evokes photoelectric potency of brain and neural network. A *detached* brain becomes five-skandhas empty as manifested in *Heart Sutra*. The name of ‘Heart’ Sutra signifies the Chan-cultivated brain that surrenders to the true *heart*, when breaking five-skandhas (form – sensation – cognition – action – consciousness) cycling. Suffering arises when one clings to any of sensory stimuli that, having been proved by brain neuroscience, often causes *stress* to the brain. *Heart Sutra* advocates how one can be totally liberated from suffering when five-skandhas cycling ceases. HHIS Chan Ding provides the true practice for realizing such miracle body, mind, and spirit. If only the brain would surrender its governing behavior to the true nature inside our heart, can one begin to clear the passage toward the Diamond (our true nature). The so-called “clear the passage” actually reflects the process of actuating TanJong acupoint at midline chest to de-block tens of thousands of qi meridians and regenerate qi flow. Blockage of meridian networks surrounding the heart results in such physical and psychological problem like chest or heart congestion, anxiety, depression, etc. Regular Chan Ding allows one to facilitate qi flow in meridian networks to keep Yin-Yang balance constantly at Tai-Ji state. In order to disclose the true nature, Chan-Ding practitioners further pursue the Yin-Yang unification, Wu-Ji

state, by transcending the Yin-Yang and WuXing state. Acupuncture and herbal techniques in TCM are mainly employed for accomplishing Yin-Yang balance and WuXing (five-element) mutual regeneration. Nevertheless, the balance can either be interrupted by amygdale responses to sensory stimuli or be driven away by sentimental attachment that cloaks *Shen* radiation. Detached brain and Wu-Ji heart realized by HHIS Chan Ding would be the ultimate solution.

Report of Results of ASQ Survey

ASQ (autism screening questionnaire) survey developed by [30] has been shown to be feasible for screening people with ASD tendency [31]-[33]. This section discusses the results of conducting ASQ survey on 2143 Chan-Ding practitioners (experimental group) and 539 control volunteers. Results of group average and standard deviation are 19.13±5.54 for Chan-Ding group and 19.80±5.68 for control group. In experimental group, the averages of AQ scores for full-lotus, half-lotus, and free-style posture are, respectively, 18.10, 19.30, and 20.16. Note that the ages of experimental group distribute over a wider and elder range (38±13.7 years) than which of control volunteers (24.6±8.2 years). To eliminate the age factor, we screen the data with ages 20 to 29 from both groups. Table II compares the results. The parenthesized value indicates the average age of the sub groups. In Chan-Ding group, those practicing with full-lotus posture apparently have lower average ASQ score (17.65).

Table II Average and std of ASQ scores of 445 control volunteers and 734 Chan-Ding volunteers with ages 20 to 29. Experimental group is further divided into three sub-groups of different leg-crossing postures.

Control group		Chan-Ding (experimental) group				
number of volunteers	average \pm stdof ASQ scores	number of volunteers	average \pm stdof ASQ scores	Chan-Ding Posture	number of volunteers	average \pm stdof ASQ scores
445 (22.3 \pm 2.1)	19.79 \pm 5.73	734 (24.5 \pm 2.6)	18.95 \pm 5.79	full lotus	281 (25.0)	17.65 \pm 5.07
				half lotus	383 (24.1)	19.39 \pm 5.96
				free style	70 (24.7)	21.77 \pm 6.22

Average ASQ score increases by 9.8% and 23.3% respectively for the half-lotus and free-style sub groups. It appears that, within this young group (20 – 29 years), leg-crossing style acts as a more dominant factor than the age factor. In correlation with TCM principle, practitioners practicing Chan Ding with full-lotus posture mostly have better mailun activation and more efficient qi circulation. They can maintain better Yin-Yang balance and WuXing

promotion state at every moment. To explore the effect of ages on ASQ score, Table III lists the average and std scores in four different age ranges. Results of control group cannot reflect statistical significance in higher age ranges because comparably fewer samples were collected. Nonetheless, Chan-Ding group exhibits a consistently lower average ASQ score without changing with age.

Table III Average and std of ASQ scores of control and Chan-Ding volunteers in four age ranges

Age range	Control group		Chan-Ding group	
	number of volunteers (average age)	Average \pm std of ASQ scores	number of volunteers (average age)	Average \pm std of ASQ scores
20-29	445 (22.3)	19.79 \pm 5.73	734 (24.5)	18.95 \pm 5.79
30-39	26 (33.7)	19.62 \pm 4.71	445 (34.2)	18.92 \pm 5.63
40-49	10 (43.2)	19.50 \pm 5.50	420 (44.5)	18.60 \pm 5.43
50-59	9 (53.2)	21.78 \pm 4.27	314 (54.0)	19.26 \pm 5.23

IV. CONCLUSION AND DISCUSSION

This paper aims to propose an optimal brain functioning scheme based on Chan-Ding model. Most of the psychological, mental, and behavioral problems are rooted at the intrinsically deficient wiring scheme of the brain neuronal network. The tendency of inevitably negative cycling of human brain has been preached in ancient document *Heart Sutra* since more than 2,500 years ago, yet, was acknowledged by neuroscientists in recent decades. As illustrated in Fig. 2, brain considers the external stimuli perceived by sensory organs and internal physiological functions as stress messengers of different strengths that require the attention and reactions of the brain.

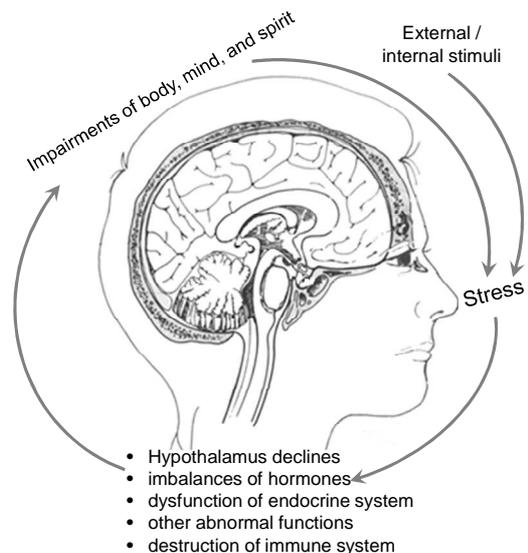


Fig. 2. Negative cycling of the brain.

Such operations consume the resources of neuronal energies and accordingly impose more stress on the body. In addition, neuropsychological researchers disclosed the negative bias of the brain [34]-[35]. Human brain is built with a greater sensitivity to negative or unpleasant news. For life safety and protection, the brain must react more strongly to stimuli causing negative amygdala responses. Consequently, bad memories predominate in the subliminal consciousness. Negative cycling tends to increase autism prevalence and other mental and psychological disorders. Coincidentally, Chan-Ding practitioners have been aware of the contamination of *Manas* consciousness (subliminal consciousness) that contains the memories of all past-life experiences, deeds, thoughts, and characters, mostly annoyed and regretful. Chan Ding enables practitioners to transcend all consciousness states, as illustrated in Fig. 3, to attain Nirvana state temporarily. Chan-Ding practitioners experience a glimpse of Nirvana while the brain becomes detached from all internal *Manas* and external sensory stimuli. They finally recognize that all sufferings are rooted in the integrated operations of brain driven by sensory organs and *Manas* consciousness, as manifested in Heart Sutra. Through HHIS Chan Ding, brain can be totally reformed and become detached and finally governed by true heart.

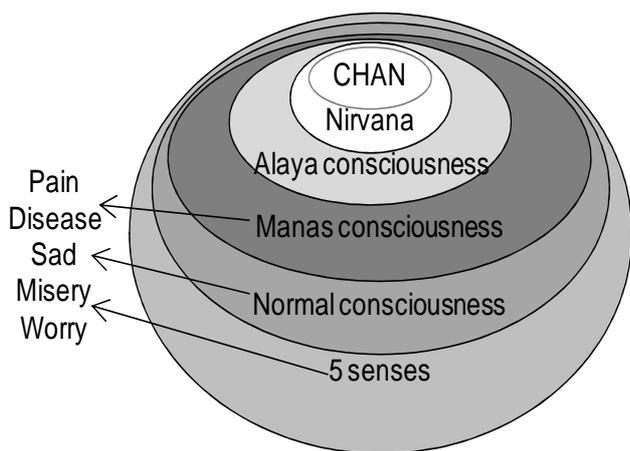
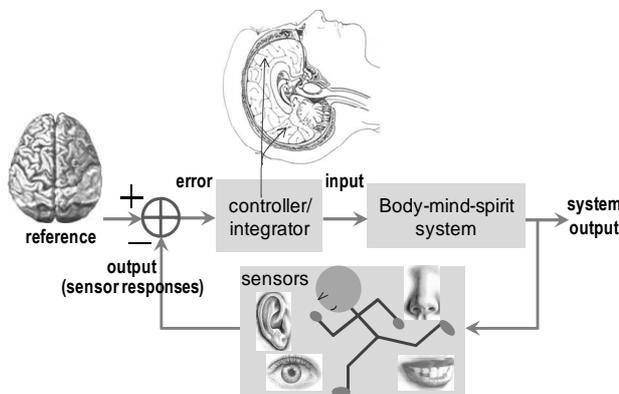
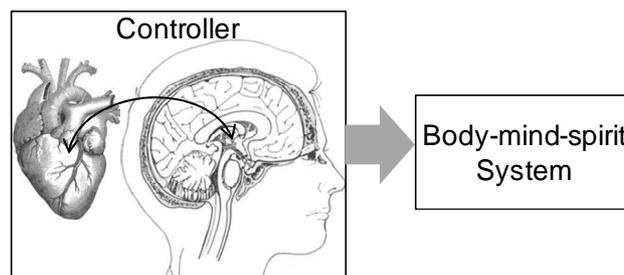


Fig. 3. Different layers of consciousness states.

Finally, we employ control theory to model the ordinary and detached brain functions. Fig. 4(a) describes the feedback close-loop model of normal, hindered brain. The design of the control scheme is to make the output of the system follow the desired goal (the reference) implicitly or intentionally set by the brain. Nevertheless, the reference cannot well navigate the body-mind-spirit system due to the poor knowledge base (stored in various consciousness layers) aggregated by intrinsically imperfection of brain wiring. In addition, the brain in response to sensory stimuli may be misled when triggering the emotional center, reward circuit, or others. In contrast, the new heart-dominant, detached brain may navigate the body-mind-spirit life system towards the healthy and blissful life even only with the open-loop control model. The essential point is the true self inside the organ heart that is equipped with eternal wisdom (*prajñā*).



(a)



(b)

Fig. 4. (a) normal brain feedback system, and (b) Chan-Ding brain driven by true-self wisdom inside the organ heart.

AppendixI HHIS Chan Ding and Ten-mailuns System

Chan Ding originating more than 2,500 years ago has been proved to benefit the health while on the way toward the disclosure of natural wisdom. In ultimate Chan Ding, Buddha Shakyamuni disclosed the eternal truth, supreme wisdom, and natural powers of the universe deeply inside the heart. Buddha transmitted the light of supreme wisdom (called Chan heart imprint) to the heart of Great Kashiyapa. The so-called Heart-to-Heart Imprint Sealing (HHIS) became the unique scheme of orthodox Chan-Buddhism propagation. Chan Buddhism was transmitted to mainland China by Bodhidharma, the 28th patriarch, about the early fifth century.



Fig. A.1. Map of ten mailuns (left lateral view).

Current patriarch is Chan master Wu Jue Miao Tian, the 85th patriarch since Great Kashiyapa. Through HHIS Chan Ding,

practitioners aim to liberate the *true self* (*Chan nature*) through body-mind-soul purification. The liberation involves the journey of transcending the physiological state, mental activities and normal consciousness, subliminal (Manas) consciousness, and the Alaya state. Experienced practitioners in deep Chan Ding often perceive golden light capable of regenerating the body and mind. Chanheart imprint from Chan patriarch plays the crucial role in the purification and accomplishment. Patriarch Wu Jue Miao Tian disclosed Ten-mailuns system facilitating body-mind-soul purification. Fig. A.1 illustrates the locations of ten mailuns.

Appendix II Meridian energy measurement

Fig. A.2 displays the MEAD instrument controlled by a laptop computer. MEAD measures the energies of 24 acupoints (Fig. A.3) to evaluate the Yin-Yang characteristics of 12 meridian channels defined in Table A.I.

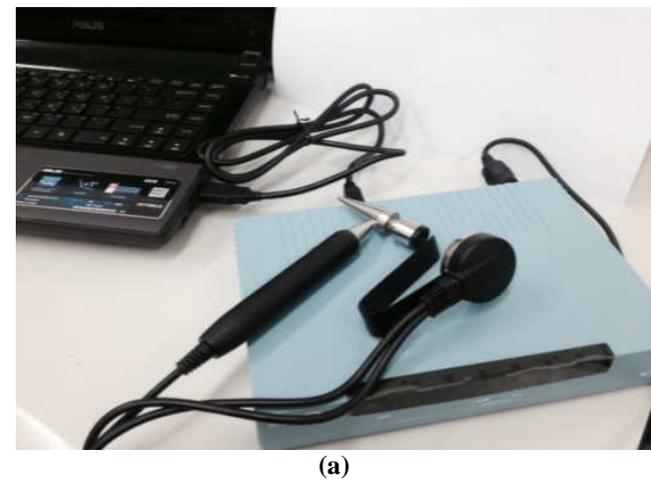
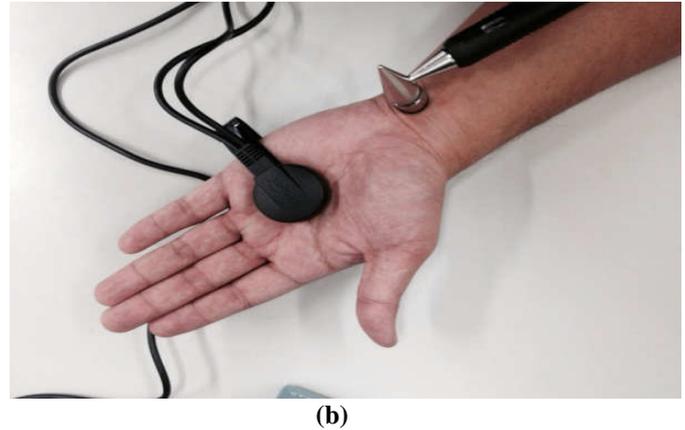


Fig. A.2 (a) MEAD (Meridian energy analysis device) connected to a laptop computer, and (b) the measuring probe is applied to the acupoint on the left wrist (HT7) with the reference probe attached to the left palm center.

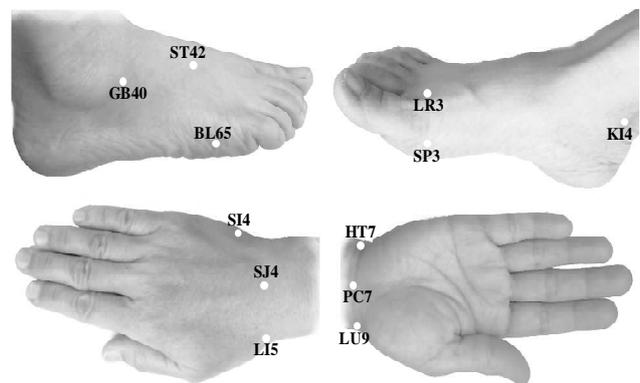


Fig. A.3. The 12 acupoints on right hand and foot. Locations of acupoints on the left limbs are laterally symmetrical to those on the right limbs.

Table A. I Twelve meridian channels and the MEAD measuring acupoints on right limbs.

	Yang		Yin	
	Acupoint Symbol/ name (compensation coefficients)	Meridian	Acupoint Symbol/ name (compensation coefficients)	Meridian
Hand	SI4/ WanGu (0.93)	Small Intestine	HT7/ ShenMen (1.11)	Heart
	SJ4/ YangChi (0.81)	Triple burner	PC7/ DaLing (0.93)	Pericardium
	LI5/ YangXi (0.81)	Large Intestine	LU9/ TaiYuan (0.85)	Lung
Foot	ST42/ ChongYang (1.14)	Stomach	SP3/ TaiBai (1.00)	Spleen
	GB40/ QiuXu (1.24)	Gall bladder	LR3/ TaiChong (1.24)	Liver
	BL65/ ShuGu (1.08)	Bladder	KI4/ DaZhong (1.00)	Kidney

The measurement is based on the mechanisms of galvanometer that measures the electrical conductance of the skin. The device was originally invented in 1958 by a German medical doctor, Reinhold Voll who was also an acupuncturist. Voll discovered that acupoints had better skin conductance. Although the scientific reliability of MEAD is still under controversial debate, it has been widely used in many TCM clinics and research organizations. In our study, we adopt the measurands as the reference in comparison with the results derived by scientific approach. Next, the 24 conductivity values (in micro ampere) measured from the acupoints are re-scaled by compensation coefficients shown

in the parentheses of Table A.I. As in (A.1), the Yin-Yang balance is evaluated by the ratio of the sum of Yin-meridian energies to the sum of Yang-meridian energies.

$$R_{Yin-Yang} = \frac{E(HT7) + E(PC7) + E(LU9) + E(SP3) + E(LR3) + E(KI4)}{E(SI4) + E(SJ4) + E(LI5) + E(ST42) + E(GB40) + E(BL65)}$$

(A.1)

In (A.1), six Yin-meridian energies are computed by,

$$E(HT7) = 1.11(HT7_R + HT7_L),$$

$$E(PC7) = 0.93(PC7_R + PC7_L),$$

$$E(LU9) = 0.85(LU9_R + LU9_L),$$

$$E(SP3) = 1.00(SP3_R + SP3_L),$$

$$E(LR3) = 1.24(LR3_R + LR3_L), \text{ and}$$

$$E(KI4) = 1.00(KI4_R + KI4_L).$$

And six Yang-meridian energies are computed by:

$$E(SI4) = 0.93(SI4_R + SI4_L),$$

$$E(SJ4) = 0.81(SJ4_R + SJ4_L),$$

$$E(LI5) = 0.81(LI5_R + LI5_L),$$

$$E(ST42) = 1.14(ST42_R + ST42_L),$$

$$E(GB40) = 1.24(GB40_R + GB40_L), \text{ and}$$

$$E(BL65) = 1.08(BL65_R + BL65_L).$$

$E(Ap)$ indicates the re-scaled sum of energies (raw values) measured from left and right acupoint Ap. Subscript L (R) indicates the left (right) limbs. Another important indicator, the ratio of the sum of hand-meridian energies to the sum of leg-meridian energies, is computed by

$$R_{U-L} = \frac{E(HT7) + E(PC7) + E(LU9) + E(SI4) + E(SJ4) + E(LI5)}{E(SP3) + E(LR3) + E(KI4) + E(ST42) + E(GB40) + E(BL65)} \tag{A.2}$$

In addition to Yin-Yang balance, WuXing promotion provides another important index of health condition. To quantify the behavior of WuXing promotion, we sum up the five ratios below. WuXing promotion is a complicated scheme. We will firstly adopt a simple and straightforward formula below to quantify the efficiency of WuXing promotion.

$$E_{WuXing} = \frac{E(LR3)}{E(KI4)} + \frac{E(HT7)}{E(LR3)} + \frac{E(SP3)}{E(HT7)} + \frac{E(LU9)}{E(SP3)} + \frac{E(KI4)}{E(LU9)} \tag{A.3}$$

As a consequence, balance behavior (RYin-Yang and RU-L) and WuXing promotion efficiency (E_{WuXing}) based on TCM are used to evaluate the meridian behaviors before and after Chan Ding (experimental group) and norm rest (control group).

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REFERENCES

- [1] Sun, X., Allison, C., Matthews, F. E., Sharp, S. J., Auyeung, B., Baron-Cohen, S., & Brayne, C. (2013). Prevalence of autism in mainland China, Hong Kong and Taiwan: a systematic review and meta-analysis. *Mol Autism*, 4(1), 7.
- [2] Lai, D. C., Tseng, Y. C., Hou, Y. M., & Guo, H. R. (2012). Gender and geographic differences in the prevalence of autism spectrum disorders in children: analysis of data from the national disability registry of Taiwan. *Research in developmental disabilities*, 33(3), 909-915.
- [3] Steinberg, J., & Webber, C. (2013). The roles of FMRP-regulated genes in autism spectrum disorder: single-and multiple-hit genetic etiologies. *The American Journal of Human Genetics*, 93(5), 825-839.
- [4] Baron-Cohen, S. (2004). The cognitive neuroscience of autism. *Journal of Neurology, Neurosurgery & Psychiatry*, 75(7), 945-948.
- [5] Happé, F., Ronald, A., & Plomin, R. (2006). Time to give up on a single explanation for autism. *Nature neuroscience*, 9(10), 1218-1220.
- [6] Sparks, B. F., Friedman, S. D., Shaw, D. W., Aylward, E. H., Echelard, D., Artru, A. A., ... & Dager, S. R. (2002). Brain structural abnormalities in young children with autism spectrum disorder. *Neurology*, 59(2), 184-192.
- [7] Dong, J. (2013). The relationship between traditional Chinese medicine and modern medicine. *Evidence-Based Complementary and Alternative Medicine*, 2013.
- [8] Spooen, W., Lindemann, L., Ghosh, A., & Santarelli, L. (2012). Synapse dysfunction in autism: a molecular medicine approach to drug discovery in neurodevelopmental disorders. *Trends in pharmacological sciences*, 33(12), 669-684.
- [9] Ghanizadeh, A. (2011). Targeting of glycine site on NMDA receptor as a possible new strategy for autism treatment. *Neurochemical research*, 36(5), 922-923.
- [10] Posey, D. J., Stigler, K. A., Erickson, C. A., & McDougle, C. J. (2008). Antipsychotics in the treatment of autism. *The Journal of clinical investigation*, 118(1), 6.
- [11] Weber, W., & Newmark, S. (2007). Complementary and alternative medical therapies for attention-deficit/hyperactivity disorder and autism. *Pediatric Clinics of North America*, 54(6), 983-1006.
- [12] Jepson, B., Granpeesheh, D., Tarbox, J., Olive, M. L., Stott, C., Braud, S., ... & Allen, M. S. (2011). Controlled evaluation of the effects of hyperbaric oxygen therapy on the behavior of 16 children with autism spectrum disorders. *Journal of autism and developmental disorders*, 41(5), 575-588.
- [13] Serruya, M. D., & Kahana, M. J. (2008). Techniques and devices to restore cognition. *Behavioural brain research*, 192(2), 149-165.
- [14] Schopler, E., & Reichler, R. J. (1971). Parents as cotherapists in the treatment of psychotic children. *Journal of autism and childhood schizophrenia*, 1(1), 87-102.
- [15] Siniscalco, D., & Cubala-Kucharska, M. (2013). Treatment of the child with autism-newest medical trends. *Autism*, 3(110), 2.
- [16] Singh, N. N., Lancioni, G. E., Manikam, R., Winton, A. S., Singh, A. N., Singh, J., & Singh, A. D. (2011). A mindfulness-based strategy for self-management of aggressive behavior in adolescents with autism. *Research in Autism Spectrum Disorders*, 5(3), 1153-1158.
- [17] Perrin, J. M., Coury, D. L., Hyman, S. L., Cole, L., Reynolds, A. M., & Clemons, T. (2012). Complementary and alternative medicine use in a large pediatric autism sample. *Pediatrics*, 130(Supplement 2), S77-S82.
- [18] Huffman, L. C., Sutcliffe, T. L., Tanner, I. S., & Feldman, H. M. (2011). Management of symptoms in children with autism spectrum disorders: a comprehensive review of pharmacologic and complementary-alternative medicine treatments. *Journal of Developmental & Behavioral Pediatrics*, 32(1), 56-68.
- [19] Sequeira, S., & Ahmed, M. (2012). Meditation as a potential therapy for autism: a review. *Autism research and treatment*, 2012.
- [20] Singh, N. N., Lancioni, G. E., Winton, A. S., Fisher, B. C., Wahler, R. G., Mcaleavey, K., ... & Sabaawi, M. (2006). Mindful parenting decreases aggression, noncompliance, and self-injury in children with autism. *Journal of Emotional and Behavioral Disorders*, 14(3), 169-177.
- [21] Ming, X., Chen, X., Wang, X. T., Zhang, Z., Kang, V., & Zimmerman-Bier, B. (2011). Acupuncture for treatment of autism spectrum disorders. *Evidence-Based Complementary and Alternative Medicine*, 2012.
- [22] Lo, P. C., Huang, M. L., & Chang, K. M. (2003). EEG alpha blocking correlated with perception of inner light during Zen meditation. *The American journal of Chinese medicine*, 31(04), 629-642.
- [23] Liao, H. C., & Lo, P. C. (2007). Investigation on spatiotemporal characteristics of Zen-meditation EEG rhythms. *Journal of International Society of Life Information Science*, 25(1), 63-71.



- [24] Huang, H. Y., & Lo, P. C. (2009). EEG dynamics of experienced Zen meditation practitioners probed by complexity index and spectral measure. *Journal of medical engineering & technology*, 33(4), 314-321.
- [25] Lo, P. C., & Chang, C. H. (2013). Spatially nonlinear interdependence of alpha-oscillatory neural networks under chan meditation. *Evidence-Based Complementary and Alternative Medicine*, 2013.
- [26] Chang, K. M., & Huang, C. L., & Sheu, J. C., & Huang, M. L., & Lo, P. C. (2014, August). Chan-Ding for Drug Rehabilitation and Its Brain-basis Hypothesis. *2nd International Conference and Exhibition on Traditional & Alternative Medicine*. Symposium conducted at the meeting of Beijing, China.
- [27] Takeuchi, T., & Morris, R. G. M. (2014). Neuroscience: Shedding light on a change of mind. *Nature*, 513(7518), 323-324.
- [28] Wu Jue Miao Tian, Chan Master (2010). *Chan Master Miao Tian's Book of Wisdom and the Guide to Heart Chan Meditation*. Publisher: lulu.com, ISBN-10: 0557188660, 1 Jan, 2010.
- [29] Lo, P. C., & Huang, M. L. (2015). Exploring preventive power of ten-mailuns actuation in chan ding. *International Journal of Preventive Medicine Research*, 1(2), 27-34.
- [30] Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., & Clubleby, E. (2001). The autism-spectrum quotient (AQ): Evidence from asperger syndrome/high-functioning autism, males and females, scientists and mathematicians. *Journal of autism and developmental disorders*, 31(1), 5-17.
- [31] Hoekstra, R. A., Bartels, M., Cath, D. C., & Boomsma, D. I. (2008). Factor structure, reliability and criterion validity of the Autism-Spectrum Quotient (AQ): a study in Dutch population and patient groups. *Journal of autism and developmental disorders*, 38(8), 1555-1566.
- [32] Wheelwright, S., Baron-Cohen, S., Goldenfeld, N., Delaney, J., Fine, D., Smith, R., ... & Wakabayashi, A. (2006). Predicting autism spectrum quotient (AQ) from the systemizing quotient-revised (SQ-R) and empathy quotient (EQ). *Brain research*, 1079(1), 47-56.
- [33] Wakabayashi, A., Baron-Cohen, S., Wheelwright, S., & Tojo, Y. (2006). The Autism-Spectrum Quotient (AQ) in Japan: a cross-cultural comparison. *Journal of autism and developmental disorders*, 36(2), 263-270.
- [34] Ito, T. A., Larsen, J. T., Smith, N. K., & Cacioppo, J. T. (1998). Negative information weighs more heavily on the brain: the negativity bias in evaluative categorizations. *Journal of personality and social psychology*, 75(4), 887-900.
- [35] Rozin, P., & Royzman, E. B. (2001). Negativity bias, negativity dominance, and contagion. *Personality and social psychology review*, 5(4), 296-320.

prajñajhana." Eight years later, he was transmitted with Buddha Heart Imprint Sealing by Chan Master Jingzai and accomplished the complete enlightenment. Thus he inherited the Chan lineage as the Eighty-fifth Patriarch since Shakyamuni Buddha. His Dharma name is Wu Jue Miao Tian. Recognizing the issue of the deterioration of humanity and the increase of social unrests and natural disasters, Chan Master Wu Jue Miao Tian vowed to awaken the Dark Ages of Buddhism with the bright dharma of Shakyamuni. He is committed to transform Buddhists from the superficial, convenient and external practice onto the correct, direct and internal practice via orthodox HHIS (heart-to-heart imprint sealing) Chan Ding, and enable everyone to witness self nature and be enlightened in this life through the "Treasure of the Dharma Eye." Hence in 1983, he began to establish Chan centres throughout Taiwan, pioneering the concept of urban Buddhism. In 1999, he was awarded the degree of Honorary Doctor of Philosophy by the Institute of International Education in New York in acknowledgement of his dedication to the promotion of world peace. To help everyone releasing from all the body-mind-spirit problems, Chan Master Wu Jue Miao Tian firstly developed the Ten-Mailuns Chan Ding that has benefited more than half a million people in Taiwan. In 2011, he founded "Shakyamuni Buddha Foundation," aimed to realize the pure land, a true paradise on earth so that everyone can live a healthy, happy, and peaceful life.

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Dr. Ming-Liang Huang was born in Taiwan in 1934, during the second World War. He graduated from the National Defense University and worked for the Ministry of National Defense until the age of forty. Suffered from impermanence during his childhood, he vowed to dedicate his life to seeking true meaning of our existence. As a result of his great commitment, he met the Eighty-fourth Chan

Patriarch, Master Jingzai and practiced "heart-to-heart imprinting