

T'AI CHI

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**Dr. Shin Lin
On Science
And Qigong**

**Qian Timing
On Wu Dang
Harmony**

**Liang Style
Baguazhang
Part 2**



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Using Science to Study Qigong, T'ai Chi

By Marvin Smalheiser

More and more evidence is emerging from the use of latest scientific testing technologies to measure the effects of long time practice of T'ai Chi Ch'uan and qigong.

Shin Lin, Ph.D., professor of Cell Biology, Physiology, and Biomedical Engineering at the University of California at Irvine (UCI), is engaged in research that has found that the practice of qigong and T'ai Chi has produced positive, measurable results.

Dr. Lin and his team measured the flow of blood, electrical conductance and capacitance, heart rate variability and mental clarity with a variety of technologies.

A martial arts practitioner since his early teens in Hong Kong, Dr. Lin's research studied over 25 qigong practitioners, many of them T'ai Chi practitioners.

He found that a period of about 15 minutes of qigong practice significantly improved results in tests with several different technologies. The studies included 10 control subjects.

While qi, considered so important in traditional Chinese medicine, is in itself not measurable by Western methods, Dr. Lin approached that problem of measuring energy by selecting surrogate markers for qi such as blood flow.

Shin Lin, Ph.D., professor of Cell Biology, Physiology and Biomedical Engineering at University of California, Irvine, has been a leading pioneer in the research on physiological changes associated with Oriental Mind/Body practices and therapies and acupuncture.

The studies reported in this article were financially supported by the Samuelli Institute for Information Biology at UCI and the Joseph and the

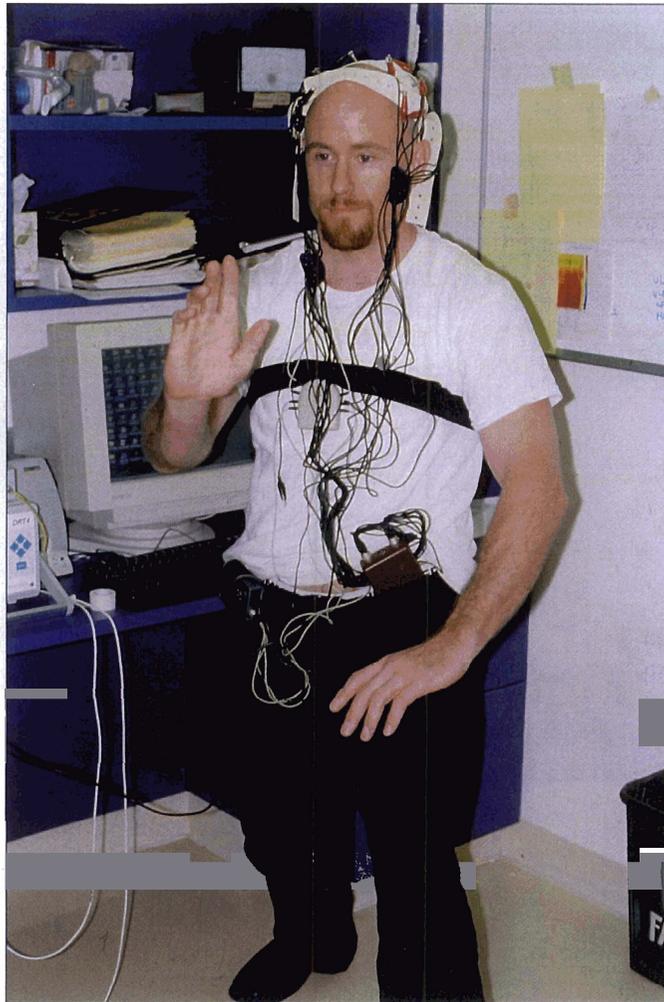
Sou-Lin Lee Endowment for Traditional Chinese Medicine Research.

In addition to T'ai Chi, Dr. Lin has trained in Wing Chun, White Crane, Tai Shing Pek Kwar, Shaolin and Wudang.

After coming to the U.S. when he was 16 years old, he graduated from UC Davis, obtained a Masters degree at San Diego State University and received his Ph.D. in biological chemistry from UCLA.

He served as chairman of Biophysics at the Johns Hopkins University, and Dean of the School of Biological Sciences Associate Vice Chancellor at UCI.

As a professor of Cell Biology, Physiology and Biomedical Engineering, he is associated with the Susan Samuelli Center for Complementary and Alternative Medicine. •



Tim Ross, a member of the research team, is in a portable recording instrument with 16 electrodes for recording electroencephalograms to study brain wave patterns.

He used an array of scientific methodologies ranging from single square voltage pulse, Gas Discharge Visualization, Laser Doppler Flowmetry as well as Electro-

encephalograms (EEG) and Electrocardiograms (EKG) to measure heart rate variability and brain wave lengths.

In addition, Dr. Lin has identified other research on qigong practice that also supports the positive effects of qigong practice. He mentioned work at Hong University, Shanghai University of Traditional Medicine, National Chiao Tung University, Taiwan and Walter Reed Research Institute.

One of the important studies by Dr. Lin and his group at UCI involved the measurement of electrical conductance and capacitance using acupuncture points.

"Based on the principles of Chinese medicine," Dr. Lin said, "one's well being internally and externally are all reflected in the strength of the qi flowing through the meridian pathways and the internal organs."

As an example, he cited pilot studies in Japan studying patients with different levels of liver disease. "They looked at the liver meridians and measured the conductance of the liver meridian. In those patients that had advanced liver cancer or liver failure, there was a very serious drop in the conductance of that meridian.

Those with cirrhosis of the liver had a significant drop in conductance.

The people with hepatitis did not have so much of a change in conductance.

Regarding his own studies, he said: "What is interesting is that when we use the technology of measuring meridian conductance with normal people and very experienced T'ai Chi and qigong practitioners we found a very substantial change, an increase in the value of conductance from before and after they did 15 minutes of T'ai Chi or qigong exercises."

To measure their conductance, one electrode was put on each jing well point. These are located on the fingertips and on the tips of the toes.

"They are very accessible and we could measure the conductance from those points to a ground electrode someplace else on the body to compare the conductance of electricity.

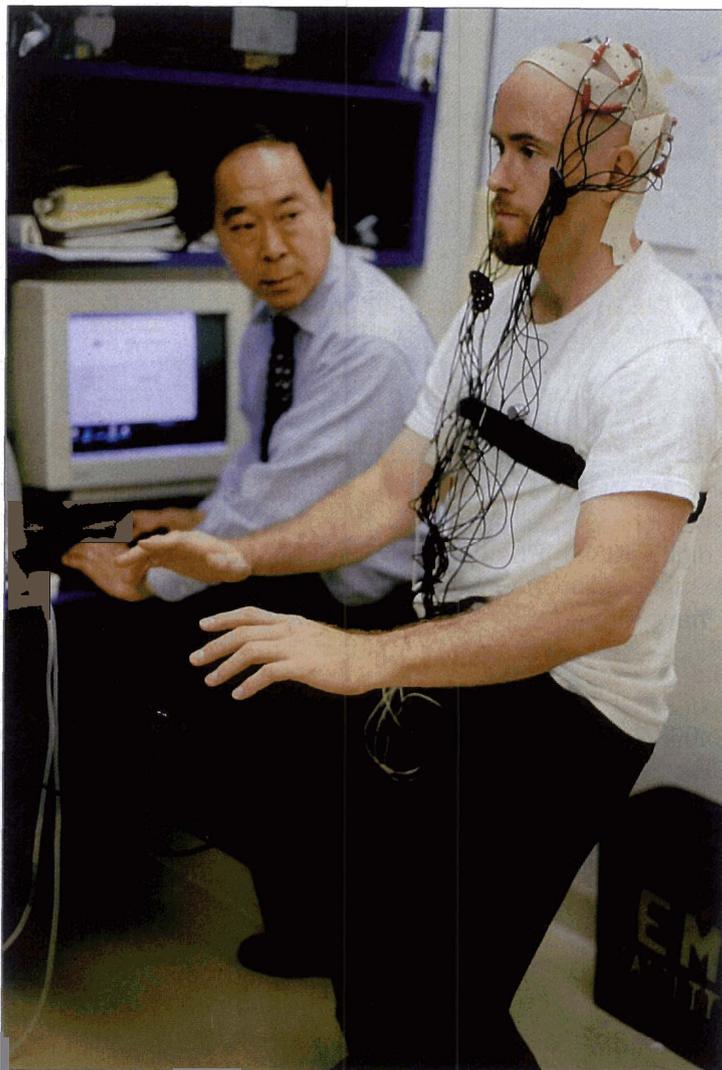
"The higher the conductance, the better the indication that the person is healthy. We measured all 12 meridians, corresponding to the major organs of Chinese traditional medicine.

"On the average, the increase in the conductance of these meridians measured at the jing well points would increase by as much as 35 percent after practice. This is a huge change. And these are very precise measurements."

In contrast, he said, the same people when asked to ride a stationary bicycle for the same amount of time before the test of conductance experienced a very small change in conductance. It was very small, less than five percent, he said.

When the participants lifted weights as part of the test, he said, there was almost no change in conductance.

"This would indicate that there is some unique function in T'ai Chi and qigong that is different from riding a bicycle or lifting weights."



The portable recording instrument can also measure heart rate variations. Results can be downloaded to computers for analysis.

"Right now, we only test people with many years of experience in T'ai Chi and qigong. We haven't gone down the ladder to measure students compared to teachers. So far, we have measured about two dozen people who have 15-25 years of experience."

"On the average, the increase in the conductance of these meridians measured at the jing well points would increase by as much as 35 percent after practice. This is a huge change. And these are very precise measurements."

Dr. Lin said that after the participants practiced T'ai Chi or qigong, every meridian increased in conductance. He said the only other way found to achieve a significant increase in conductance was to get an acupuncture treatment.

The T'ai Chi participants, he said, were Yang and Chen styles although Dr. Lin says he intends to bring in people who do other styles of T'ai Chi. He also noted that those practicing Chen style first routines were found to have more improved conductance than after doing the second Chen routine, which is more vigorous.

Raising the conductance, he said, is a good thing. "When conductance goes down, it can be really bad for the individual."

He said the increase in conductance also reflects an increase in blood flow, which is also beneficial.

In T'ai Chi and qigong, teachers frequently say that if you are doing it correctly, your intention leads the qi and the blood flow, which move together, Dr. Lin said.

"A lot of times after doing T'ai Chi or qigong, the teachers will ask if your

hands are warm or feel tingly and expanded. These are indications of increased blood flow."

Another experiment by Dr. Lin's team analyzed the heart rate variability, or the changes in the beat rhythm of the heart using electrocardiograms.

He said there is a lot of research that indicates that the greater the heart rate variability, the more relaxed a person is, such as during deep restful sleep.

He described heart rate variability as the time between heartbeats. If the timing between the first and the second and successive beats are each slightly different, that is beneficial and indicates a person is really relaxed, he said. "If you are really tense, then research indicates that the interval

between every beat will be exactly the same.”

“We have found that when people are in a state of qigong meditation, they will show a lot of this high rate of heart rate variability, indicative of deep relaxation.”

During the meditation, he said, people would be sitting still and have a single point of focus, perhaps on the dantian or on their breathing.

“Some people don’t regulate the breathing. They are in a special state, almost a trance state. From an analysis of the EKG, we see that they are in a very deep restful state.”

Dr. Lin said that study participants wore miniaturized monitors on their body and head, so that he could continuously record the EEG and EKG functions continuously for 24 hours. The computer can then analyze the heart rate and the brain waves.

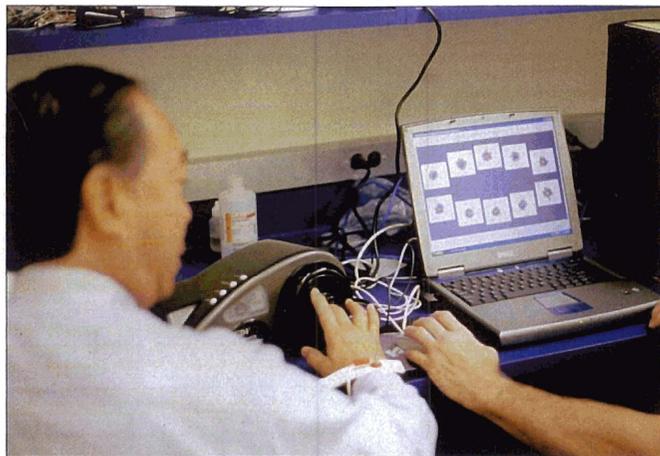
“There were very interesting brain wave patterns showing the meditators were in a deep restful state. In addition, we could see that they were not sleeping because they also had signs that their minds were deeply concentrated. It is called focused relaxation. They have both short wavelengths and long wavelength brain waves at the same time.

“That shows that they are reaping two types of benefits. They are getting deep rest and at the same time sharpening their mind for their daily activities. It is a very beneficial thing to do.

He said that most of the study subjects were T’ai Chi practitioners and many of them did meditation.

“So when I say a person is a qigong practitioner, they usually also do T’ai Chi and meditate and do deep breathing exercise. Qigong training involves regulating the body, respiration and the mind. T’ai Chi when done properly also involves these factors so it is a type of qigong.”

“With the use of Laser Doppler Flowmetry, we showed that certain



Dr. Shin Lin, left, is using a computerized Gas Discharge Visualization instrument, also known as digital Kirlian Photography. Each finger can be examined. T’ai Chi and qigong practice were found to have altered the image, indicating a change in energy fields as a result of practice.

qigong movements significantly increase cutaneous blood flow measured at the Laogong acupuncture point (PC8) on the palm. We also found that some movements are more effective than others in producing this effect.”



Dr. Shin Lin in a Wing Chun combination block-strike

Dr. Lin said that research studies also found that people doing deep breathing exercises also produced increases in blood flow.

“When they did T’ai Chi movement coordinated with breathing there was a bigger blood flow increase.” However, he said that if the coordination was not synchronized correctly, there was no increase.

Another part of Dr. Lin’s studies at UCI was independent component analysis, which means they were able to analyze many things independently.

“We can simultaneously monitor the alpha waves, beta waves and theta waves. When a person is relaxed, the brain waves slow down. Then they show more slow waves, theta waves. They also show more fast waves, alpha waves. So, they generate both fast and slow waves.

“In the past people were not aware of the fast waves. They just think, ‘Oh, a lot of slow waves.’ They were not aware of the fast waves. People just think a lot of slow waves mean the brain is slowing down. In fact they have both fast and slow.

“Slow waves are indicative of relaxation. Fast waves are indicative of focus. So these people when they meditate, they are both relaxed and focused. This is different from sleeping. When people are sleeping they may be relaxed but not focused.”

“Why is it good for you? It is good for you because you get a lot of rest within a short period of time. That is because this is very deep rest. This is very good for you. But you are also practicing your concentration. Most of us have trouble concentrating. We have too many thoughts and words in our minds.”

Dr. Lin said that during one research study at the University of Arizona Medical School, they took the medical students and divided them into two groups. “One half of students were taught how to meditate. The other were not. After a period of time, one semester or a

year, they found that the people who practiced meditation, did a lot better in their grades and were able to focus a lot better.”

So meditation gets you two benefits: relaxation and training your mind to be focused.

“In T’ai Chi they talk about movement and breathing. They both influence the flow. If you are tense, your blood vessels are constricted. So you do not get good blood flow.

“T’ai Chi calls for relaxation and focus. We are taught to focus on the hand and relax. So doing Wild Horse’s Mane, you focus on your hand. Your mind is focused on hand. Similarly, in Cloud Hands, when you are focused on your hand, you are not focused on anything else.

“When you train your mind to focus on one subject it is like when you have to study for an exam and have to focus on the book and not on neighbors music or radio. Practice to improve focus is very important. Most of us can use a little more of that.”

Dr. Lin mentioned Prof. Patrick Walsh, professor of psychiatry at UCI and who also wrote a number of books on the benefits of meditation.

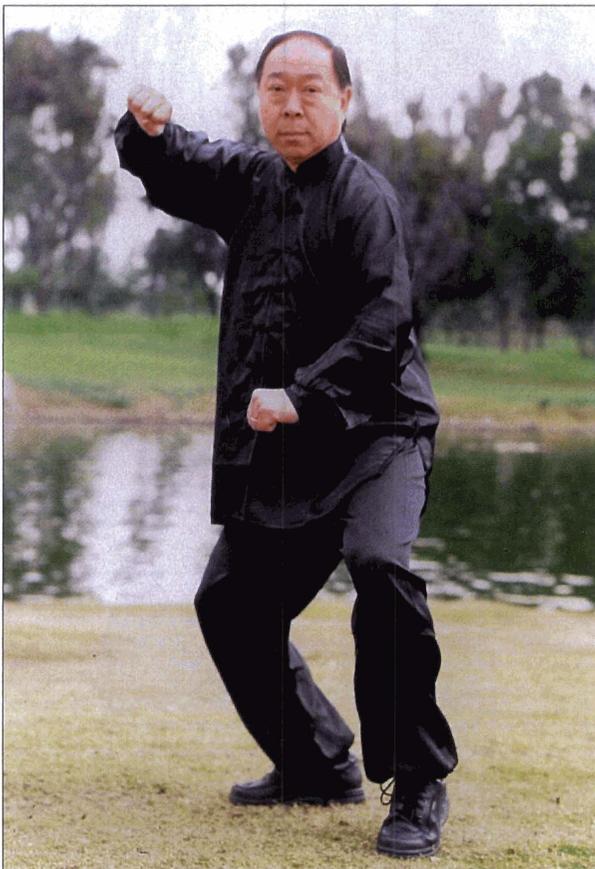
“He usually begins his lecture by saying, for the normal person, the mind is out of control. The normal person is constantly bombarded by too many ideas. Listening to the radio, driving, talking on a cell phone, worried about this and that and running from one place to another.”

Dr. Lin said, when you do T’ai Chi, “You focus on your hand, on your breathing and you don’t do that with the radio or TV on. You focus on your breathing and movement and hand. The reason I give you this information about meditation is that meditation is T’ai Chi without movement. T’ai Chi is a type of meditation because it is really focused relaxation. It is not like going to sleep.

Dr. Lin and his team also did tests of breath holding in qigong



A Chen Lao Jia second routine posture.



A Chen Lao Jia posture.

and T’ai Chi Ch’uan and measured the benefits through photo migration spectroscopy.

This shows the benefit of breath holding in advanced qigong and advanced T’ai Chi. He said in this breath holding, you do more than just deep slow breathing. Oftentimes there is a breath holding step.

In a simple qigong exercise, he said, a person breathes in and breathes out. Breathe in, breath out. “But in this method, you breathe in and hold the breath for about seven seconds and then breath out.”

Why hold the breath? To explain this, Dr. Lin showed what he called a photo migration spectroscopy instrument that allows him to put a laser beam on a point. Then he can measure the beam going in and coming back out.

“In this way we can continuously monitor the level of oxygen and CO 2 in blood vessels of the head by measuring their absorption by the laser.”

Dr. Lin described using the laser on the chest of a T’ai Chi expert who does a complicated breathing method that involves holding the breath when pushing.

Dr. Lin said that when his breath is halfway in, he holds his breath and then breathes out.

“Now we know why, said Dr. Lin. “When he breathes in, his oxygen goes up, and when he breathes out his oxygen comes down.

“He breathes in halfway, oxygen comes up half way, and when he holds his breath, his level of oxygen shoots up.

“When he holds his breath, there is an extra boost, a shot of oxygen to the brain. Which is counter-intuitive.”

By holding the breath, more oxygen goes to brain, Dr. Lin said.

“The conclusion here is that doing the breath holding provides an extra boost of oxygen going to the brain.

“So we can look at it both ways. From medical physiology

point of view, how is it possible that by holding the breath, more oxygen goes to the brain?

“The explanation is this. The brain is the most important part of the body. So the body has a special mechanism to preserve the brain, as the top priority.

“So when you hold your breath, you don’t have enough oxygen for the whole body. So the brain is the most important part of the body. So the brain blood vessels dilate. This allows more blood flow to compensate for the lack of oxygen.

“When you hold your breath, you are running out of oxygen, the brain gets the signal. ‘Oh, oh, brain is not getting enough oxygen, the brain is going to die.’ Brain blood vessels expand to have blood flow compensate for this.

“The dilation of blood vessels is an important self-preservation mechanism. It is the same thing when breathing out and holding the breath. Then more oxygen also goes to the brain.”

Dr. Lin said when a person does this type of breathing and holds his breath; the person is enriching the brain with oxygen in the short term. So if a person is tired and holds his breath, you actually waken the person.

“Also, this particular subject is 50 years old. I did comparable plots of T’ai Chi qigong people who were 65 and 67 years old and they all get this big spike when they hold their breath.

“What if you just get 10 people who have never done qigong or T’ai Chi before randomly and tell them to hold their breath? happens?

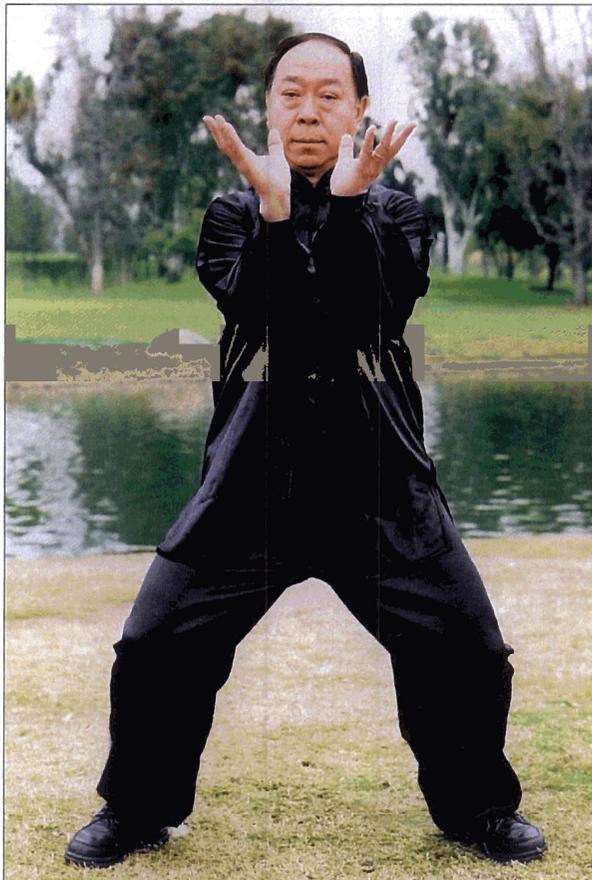
“The young people (teens and 20s) showed a big increase in oxygen in the brain; middle aged people got much less of a peak.

Older people in their 60s and 70s, don’t get much of a peak. And if they are 80 or older, they don’t show any peak.

It would appear that for those 80 years old or older their blood vessels don’t have flexibility any



A Wu Dang Qigong posture, Pulling Qi.



Pan Gu Qigong’s Holding Chrysanthemum.

longer. But the people in their 50s and 60s still have full ability to dilate the blood vessels.

Dr. Lin said there could be the long-term benefit of this kind of breath holding exercises. People who do T’ai Chi and qigong are exercising the brain blood vessels all their lives and they have not atrophied, compared with people their own age because of the lack of exercise.

“So one could make the case, although this is very preliminary, that these exercises are exercising the blood vessels of the brain and keeping the blood vessels flexible.

“Because of this, it would be important to get people who are older or with arteriosclerosis and things like that and teach them this and then monitor them and see if it is possible to reverse the pathological stage.”

When asked if holding the breath create stress, Dr. Lin said:

“You have to be careful. Obviously if the person has blood or heart problems, that person shouldn’t be doing this. This again is something you shouldn’t overdo. If you can only hold your breath for three seconds then you shouldn’t try to go for seven seconds and as a result pass out.”

Dr. Lin also cited a study at Hong Kong University by Dr. Brian Jones that involved a qigong method of breathing and stepping used in China for cancer patients.

“This was a controlled trial by our colleagues at Hong Kong University. A group of 20 subjects who had never learned any qigong or T’ai Chi before were taught Guolin qigong.

He said Guolin qigong is very simple. “It is a type of repetitive stepping coordinated with breathing in and out. It is very popular in China among cancer patients. So at Hong Kong University, they taught 20 people Guolin qigong to people who had never done it before.

“Each week they took blood samples of these subjects. They were very sophisticated in the

way that they did it. They analyzed not only white blood cells. That would be too crude for them. They counted two groups of white blood cells.

"They found a substantial decrease in the stress hormones cortisol and interleukin 10, which suppress anti-cancer immunity. There was also an increase in interferon, which protects against cancer, in the blood stream.

Interleukin 10, Dr. Lin said, is not something you want to increase. "It is anti-inflammatory. It suppresses the immune system. When people practice qigong, the interleukin 10 comes down and the interferon gamma goes up.

"The ratio is going up because they are getting interferon gamma and less interleukin 10 and that is exactly what you want if you want to fight cancer.

What is common denominator between Guolin and other qigongs and T'ai Chi?

Dr. Lin said it is mental focus, and deep breathing. And instead of doing difficult movements, they walk. "Walking is their movement. But they could walk one or two hours a day and just do deep breathing.

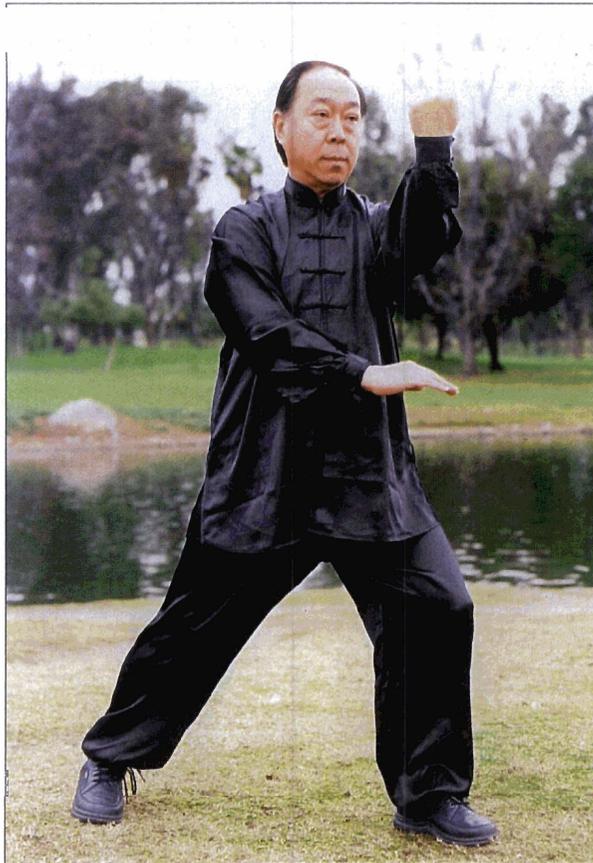
"It is very simple, easy to learn, and something you can do for an hour or two a day.

"If you are already healthy, you just need to maintain yourself. You don't need to do a couple of hours a day of Guolin qigong."

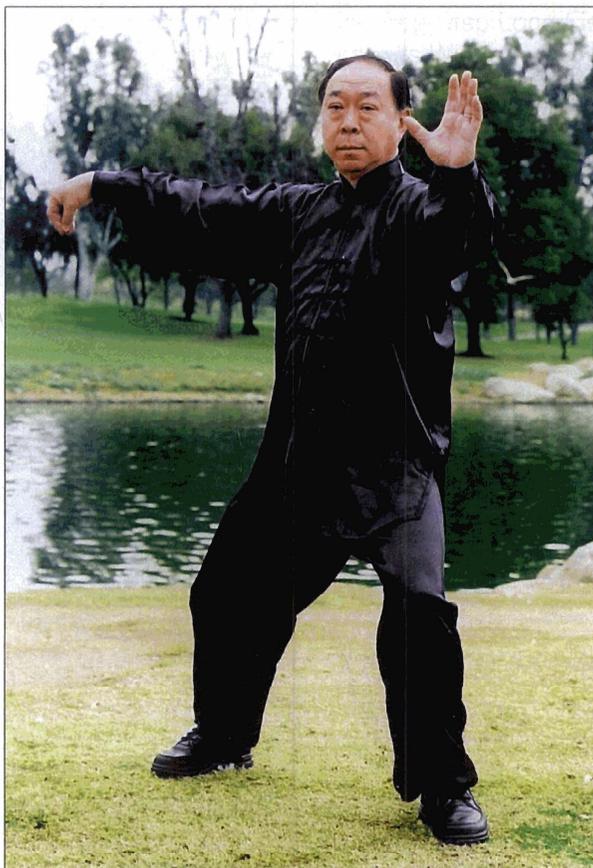
Dr. Lin has also used Gas Discharge Visualization, or digital Kirlian photography, to study the effects of qigong and T'ai Chi on the bioelectromagnetic fields of the body.

Dr. Lin said digital photography improves the usefulness of Kirlian photography by making it possible to take a picture and download the results to analyze on computers for brightness, aura intensity, shape and fractility, whether it is broken up or less smooth.

This method, he said, measures the energy field a person



Hsin I 5-Element's Water Fist.



Yang style Single Whip.

has. If you have a lot of energy, your hand has a lot of electromagnetic energy.

"How do you measure that? You put the person's hand on a high voltage plate and it draws the electrons out, creating an aura on the plate.

"We can then measure the intensity of the aura and the result is a reflection of the level of electromagnetic energy you have in the hand.

"A lot of people after they practice T'ai Chi, say, 'I have a lot of energy, my qi, my hand, I feel very good.' That is very subjective.

"Now I can say put your hand here. And we will take a picture and see if the aura shows it is stronger. We can analyze the picture for 27 parameters."

Dr. Lin and his group have just begun using this technology, but he said that a brief study done elsewhere measured the results of change among people doing meditation, T'ai Chi, progressive muscle relaxation, acupuncture and other disciplines.

The results showed that of the people who did T'ai Chi, 65 percent showed an increase in the aura image after practicing

Another area of parallel research that Dr. Lin has come across is in the area of repetitive movement because of its effect on the area of the brain that produces serotonin, an aid to smooth muscle relaxation.

"Repetitive movement is very important. When I teach people T'ai Chi, I tell them not to forget the warm-up exercises.

"T'ai Chi is not repetitive; it is all different movements. On the other hand, why do chan ssu jin for a half an hour? Actually that repetitive practice has special value as compared to doing an entire form composed of many different movements."

He cited research done at Princeton University on animals that showed that cats, when they do repetitive motion, such as grooming themselves, stimulate an area of the brain that produces

serotonin. It can produce up to 2-5 times as much as opposed to non-repetitive movement.”

“When people are low in serotonin, they are clinically depressed. They can’t sleep; they have insomnia and have poor appetite.

“The extrapolation is that if cats do repetitive motion and increase their serotonin in the brain, when we do all these repetitive motions we generate more serotonin.

“That is different from doing the whole T’ai Chi routine, whose movements are not repetitive. So, don’t forget warm-up exercises. Those potentially help generate serotonin levels, which makes you sleep better, and helps prevent depression.”

He also mentioned research that indicates you can do repetitive movements two ways, one is actually doing them and also by imagining that you are doing them.

“At UCI, we have one of the country’s most powerful MRI instruments and we can see which part of the brain is active and which part is not. Functional MRI can determine the oxygen consumption in different parts of the brain.

“We at UCI were one of the first people to show that if a person literally moved his fingers with the right hand, the left side motor cortex was activated. That is how the brain controls motor movement.

“Interestingly, they told the subject to not really move the fingers, but visualize moving the fingers. This also activates the motor cortex. This will also stimulate serotonin level but not as good as doing it.

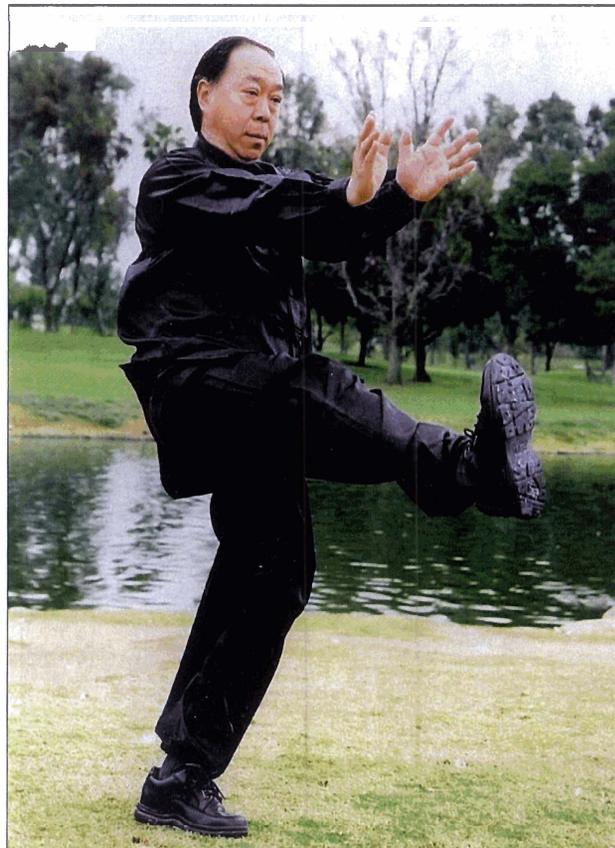
“A functional MRI will show if you visualize something, you create a substantial effect in the brain.

“Serotonin when elevated promotes better sleep, appetite, digestion and moods. It is like people taking prozac.”

Again, Dr. Lin said research



White Crane's Jiw grabbing movement.



Bagua Palm's triple palm and leg strike.

on body regulation shows the beneficial effect of muscle contraction.

T’ai Chi is such a mild form of exercise, how good is it for weight reduction or calorie burning since in T’ai Chi you don’t burn much calories, Dr. Lin asked?

Muscle contraction itself, regardless of calories burned, induces the production of interleukin 6, which produces many downstream effects such as weight control, insulin sensitivity, breakdown of fat and glycogen, he said.

“Don’t we all wish for weight control, the breakdown of fat and improved insulin sensitivity?

“How is it possible? A group in Sweden found that when people exercise, there is a very quick increase in interleukin 6, but when their exercise is too much, then it comes down.

“You want interleukin 6 to go up. But you should exercise only so much. Exercise too much then it goes down. Why is interleukin 6 important? The muscles produce interleukin 6 and it then goes out to the fatty tissue, adipose tissue, where it breaks down the fat.

“If you have a pot belly, do sit ups. Interleukin 6 breaks down the fat. It goes to the liver and breaks down glycogen. And then it produces glucose to nourish the rest of the body.

■ “On the other hand, if you exercise too much, then it will affect the stress hormones.

“While T’ai Chi is a very mild form of exercise, while it doesn’t burn up a lot of calories, this shows it is still good for these things because if you do it just the right amount, it secretes interleukin 6 that will break down the fat and increase insulin sensitivity, and so forth.”

Dr. Lin said one of the major differences between T’ai Chi and other forms of exercise is that it emphasizes relaxation while other exercises can create stress the more you do them.*