

explore and analyze the mechanisms of the physiological effects generated by the Qigong state.

#### 1. THE EFFECTS OF THE PRACTICE OF QIGONG ON THE EEG

Hu Linqi and others recorded ordinary EEG of 30 subjects practicing relaxation Qigong and analyzed the power spectrum. In the first systematic test before the subjects had learned relaxation Qigong, there were no clear differences between the duration of power, and prior to power, in the various frequency bands of the EEG power spectrum. However, after three months of Qigong training, the EEG alpha wave band occupied a markedly increased percentage of the entire power spectrum. The EEG power spectrum array analysis also showed a gradual increase in the alpha wave spectrum energy. The rise in the EEG wave index is acknowledged as representative of the degree of relaxation. Therefore, any type of positive state can lead to an abatement of the alpha rhythm. We can see from the results of analysis of the power spectrum in the EEGs in this experiment that the alpha wave proportion of the EEG power spectrum of the group practicing Qigong showed a clear increase during the course of practicing Qigong compared to what it was prior to practicing Qigong. We can detect in the EEG power spectrum array that during the entire 15 minutes of Qigong exercise the EEG alpha wave spectrum energy increased. This illustrates that the alpha wave increase actually reflects the degree to which the cerebrum enters rest during the exercise. Furthermore, the degree of entering rest gradually increases.

Zhang Jianzhou and others conducted an analysis of statistical charts of the electrical potential in the EEGs of the Qigong functional state. The EEGs of a group of Qigong masters (a total of ten persons who had all practiced Qigong for more than ten years) taken before the Qigong exercises and eight minutes into the Qigong exercises when they were in a Qigong functional state were compared. A single line can be seen on the T test isopotential distribution chart. The cerebrum frontal hemisphere alpha 1 component shows the clearest changes ( $P < 0.05$ ). From the isopotential distribution graph of another related factor we see that there was a weakening correlation or a negative correlation of the vast majority of the EEG components. In order to explain the changes in the interrelationships between the various parts of the brain in the EEG after entering a Qigong state, they also conducted analysis of correlated isopotential distribution graphs. The design was to divide the cerebrum into four sections, the left front, right front, left rear and right rear and still emphasizing the observation of the alpha 1 rhythm. The positive correlation between the left and right and the negative correlation between the front and rear can be seen. The control group (ten healthy individuals) also had their EEGs recorded into three bands. This group closed their eyes and sat quietly for five minutes and then relaxed (imitation of Qigong) for ten minutes, and then sat quietly for five minutes. On the EEG change T test isopotential distribution chart of this group we can see that their "degree of greyness" is lowest. This illustrates that there was no clear change in their EEG from the time they closed their eyes and sat quietly to the time they copied Qigong. Analysis of the correlation index of their isopotential distribution chart shows that their "degree of grayness" was highest, indicating the strongest positive correlation, there was no antagonism. It was completely

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different from the negative correlation in the electrical changes in the frontal and rear portions of the brain after a Qigong master has entered the functional state. This experiment illustrates that when a Qigong master enters the functional state, there is a pattern to the changes in the EEG. These are primarily manifest in the increase of forward cerebrum and the central area alpha 1 components. Furthermore, as for the colonies, this type of increase is of clear significance. As for the overall brain, the increased alpha 1 rhythm indicates that there is an increased orderliness to the cerebrum activities. This obviously is not a type of state between sleep and waking, and is not a controlled state, but is a special type of state of excitation.

Some people have discovered that as the time a person stands is extended, the Q wave and the alpha wave indexes increase in the EEGs of both the Qigong group and the control group. However, the increase is sharper in the Qigong group, and furthermore, the increased value of the Q wave is clearly higher than that of the control group. This indicates that when experienced Qigong practitioners stand and enter a deep relaxation state, the central nervous system nerves are in a highly orderly state, and the central brain has strong control and coordination capability. The increase of the Q and the alpha waves are one manifestation of the increased synchronization of brain cell activities. This is the increased mutual coordination function of the cerebral cortex and the lower structures in the enter relaxation state. It signifies the enhanced operational state of the cortical centers.

Niu Xin and others used relatively advanced computer signals processing systems to perform power spectrum analysis during Qigong external aura of the person being acted upon, a normal persons EEG under the effects of infrasonic sound, and the EEG of a Qigong master entering relaxation and transmitting an external aura. They searched for the central reaction of the Qigong state and the Qigong external aura from a neurobiological perspective. There were significant changes in the EEG power spectrum in the external aura subject group ( $P < 0.05$ ). The changes in this group's EEG power spectrum were characterized by an increase in the frontal energy. Forty one subjects in this group showed an increase in frontal lobe energy after being acted on by external aura. Nineteen subjects in this group showed signs of frontal block reversal. Twenty three subjects from this group displayed high energy at various leads. Thirty one subjects showed synchronization of the alpha waves and compared to before being acted on the external aura, the average power spectrum peak moved toward the alpha frequency. The changes in the six subjects with relatively complex transmitting state EEG waves all showed increased frontal power and all leads had high power. This appeared to be an overall increase in the EEG power spectrum. The peak tended toward the b wave. There were many harmonic peaks on either side of the main peak. There was no frontal block reversal. It appeared to be synchronized brain waves. There were active changes in the frontal lobe EEG when the subject was in the Qigong state. This illustrates that the practitioner of Qigong can use his actions of his conscious will to influence the functions of his internal organs. At the same time, entering relaxation had a positive regulating effect on the higher centers of the brain. During this process, the skin resistance, pulse rate and breathing all slowed down, indicating that that

the cerebral cortex was under protective inhibition. During positive rest and reorganization, the mutual inhibiting effects of the lower level automatic nerve centers were reset, and there were a series of indications of increased tensity in the vagus nerve. After entering relaxation, the body was in a "brain relaxed, internal organs active" Qigong functional state. We discovered that as the testing time was extended for normal persons, it was also possible to record occasional EEG changes which were similar to those of the Qigong functional state, but these changes were less in degree, followed no pattern and had no statistical significance. From another aspect, when normal people go through Qigong training, they are completely capable of entering the same sort of functional state as the Qigong masters and display similar changes in the EEG waves, the power spectrum of the EEG in the functional state is more complex. This can be due to the fact that the Qigong masters practice different types of Qigong, and the locations from which they transmit the aura are different. When they are transmitting the aura, they manifest an overall power increase in the power spectrum in the various leads and these are not synchronous. This is the cortical inhibition of the Qigong master from the time of entering relaxation, skipping to the cortical excitation process, and switching from the synchronized to the non-synchronized b wave EEG waves. This explains the speeding up of the EEG rhythm, the cortical neuron activity, and enhanced excitation and tenseness. During the process of the Qigong master entering relaxation, he makes a series of adjustments in entering the functional state. The cerebral cortex functions also go through two completely separate functional states. This is the nervous mechanism of the Qigong master switching from a psychological process to a physiological process. The conclusion is that during the process of Qigong entering relaxation, the EEG power spectrum shows changes in Q synchronization, characterized by an increase in the frontal lobe alpha wave power spectrum. During the functional state, the EEG power spectrum tends to be b wave form, displaying desynchronized EEG waves, and an increase in the power spectrum energy of all leads.

Hong Zhi and others used a computer to analyze and study the EEG characteristics of a super relaxed state. The thought activities of the human brain play the role of the director in entering the super relaxed state, and the frontal area is the area of the brain most recently formed in the evolutionary process of the human brain. The frontal area is the place where nervous processes become thought processes, and is an important area of conscious activity. Therefore, they an EEG signals analysis of the frontal area as a beginning to recognize normal states of relaxation and states of super relaxation, and found common characteristics of super relaxation. There were eight people in the Qigong group, all of whom had practiced Qigong for three years or more. During the tests, the EEG of each person was recorded for 40 minutes. Five minutes were prior to Qigong, 30 minutes during Qigong, and five minutes after Qigong. The control group were requested to copy the Qigong group for the test. The results were: The frontal area EEG showed marked differences between super relaxation and common relaxation. During Qigong super relaxed state, the EEG power spectrum greatly increased, with the spectrum peak frequency moving down. The largest spectrum peak location reached 4.7 Hz. That is the transition from the pre Qigong alpha wave dominance to a large concentration of Q wave energy. The amount of shift in the power spectrum was directly related to the degree of

enter relaxation.

## 2. EFFECTS OF PRACTICING QIGONG ON CEREBRAL HEMOGRAMS

Liu Yuanliang and others observed the effects of Qigong training on cerebral hemograms. There were 72 persons in the Qigong group, and all were patients with various chronic ailments who practiced Qigong. The average of those in this group was 50. There were 27 persons in the control group. They were patients with various chronic ailments who did not practice Qigong. Their average age was 47. The Qigong group practiced Qigong four to five hours every day. Prior to practicing Qigong, 22 of the 72 in the Qigong group had normal brain blood flow. After practicing Qigong for three months, the number with normal brain blood flow shot up to 42, or almost double what it was. Also, there was a clear drop in the numbers of those with insufficient blood flow and those whose readings were too high. In the control group, there were 15 of the 27 with abnormal brain blood flow. After the course of treatment was over, the number of those with normal brain blood flow increased by one or two. There are clear difference between the two. The results of the brain blood flow chart amplitudes after statistical analysis are: any member of the Qigong group with insufficient brain blood flow all showed an increase in all four channels. The difference between before and after practicing Qigong was extremely apparent ( $P < 0.01$ ). At the same time it was discovered that those with slightly high brain blood flow prior to practicing Qigong had reductions in this blood flow to varying degrees. There was an extremely apparent difference before and after practicing Qigong ( $P < 0.01$ ). Those with normal brain blood flow prior to practicing did not show any apparent change. This illustrates that practicing Qigong has duplex action to increase brain blood flow in those with insufficient brain blood flow, to lower the brain blood flow of those whose brain blood flow is too high, and does not effect the brain blood flow of those with normal flow.

Liang Feng and others observed the effects of Qigong on brain blood flow. Their subjects were 15 college students. They practiced Qigong for six months or more. During the experiment, they observed that the blood flow volume rose at a clearly higher rate after practicing this exercise for 15 minutes than before this exercise ( $P < 0.01$ ). The increase in the rate of the rise in brain blood flow illustrates an increased blood flow volume, and provides the tissue with the increased oxygen and nutrients it requires. At the same time, the accelerated metabolism of waste improves the function of the brain, so the brain can maintain a high level of operational effectiveness, and plays an active role in preventing hardening of the blood vessels in the brain and in improving the metabolism capability. The practice of Qigong entering relaxation can lower the energy consumption of the brain, reduce noise interference, increase the activities of the cells, so the nerve cells in the brain are more synchronized and more ordered, and the brain is in optimal state for processing internal and external signals.

Tao Shouzhong and others observed changes in the cerebral hemograph of those practicing Qigong relaxation and recuperation. They observed the amplitude of the cerebral hemographs of Qigong masters 10, 20, and 30 minutes after entering relaxation. These readings showed a clear drop to those

before practicing entering relaxation ( $P < 0.01$ ) and these reading basically returned to the level prior to practicing Qigong after ten minutes of natural rest following the Qigong exercises. There were no clear changes in the readings of the control group during the entire process of the experiment. This experiment shows that after Qigong entering relaxation the entire body is in a kind of special physiological state - the Qigong functional state. The results of this experiment are markedly different from the results of the other experiments mentioned above. It is possible that different types of Qigong and different methods have different effects on the brain blood flow. Additional future study must be made of this.

Bao Guojin and others observed the effects of practicing Qigong on the brain electrical resistance chart. Those training in Qigong were 38 persons who trained for two hours every day in the Shaolin internal muscle one-finger Dhyana. The brain electrical resistance was checked prior to the training and after 30 days of training. Four readings all became normal wave forms. After the training, the brain resistance chart wave amplitude, flow volume speed, resistance index, and elevation time were all sharply different from before beginning training in Qigong. With the exception of right side resistance index and rise time, all other six indexes showed extremely marked differences ( $P, 0.01$ ). This illustrates a relatively great effect of the practice of Qigong on the brain electrical resistance chart, suggesting that training in Shaolin internal muscle one-finger Dhyana acts to increase brain blood flow.

The cerebral cortex is the highest level or regulation of human body functions and activities. It is also a primary material basis for exercising the highest form of biological activity (thought). The brain is the most complex and functionally most perfect system in the natural world structure. At the same time the brain is adjusting between the body and the environment and among the various levels within the body, it is also acting to regulate itself. A study of the EEGs and brain blood flow charts indicates that the practice of Qigong entering relaxation can restore and improve the functional activities of the cerebral cortex. The brain is regulating and control center for the body's automatic systems. It is an organ of key importance in maintaining the health of the body. Therefore, when entering relaxation acts to have a beneficial effect on the functions of the brain, it must play an important and extensive regulating role over the entire body, putting the entire system of the human body into a kind of entirely new functional state.

## V. THE EFFECTS OF QIGONG ON SKIN ELECTRICAL REACTION AND SKIN TEMPERATURE

### 1. THE EFFECTS OF QIGONG ON SKIN ELECTRICAL REACTIONS

The skin electrical potential activity is an excellent index of the functional state of the sympathetic nervous system and its reactivity. It is also related to emotional activity. Lin Yagu and others observed the changes in skin electrical reaction wave phase during the process of practicing Qigong. They discovered that healthy individuals and sick individuals display different phases. This is primarily related to the state of the body at the time of the experiment, the phase was different at different parts of