

## SOME THOUGHTS ON NEUROPHYSIOLOGICAL BASIS OF YOGA

B.RAMAMURTHI\*

Department of Neurosurgery, Dr. A. Lakshminpathi Neurosurgical Centre  
V. H. S. Medical Centre, Madras-600020, India

*Abstract: - Yoga presents the culmination of efforts made by mankind till now control mind and behaviour. It is living science, practiced in an elementary fashion by many in India. While a few perhaps are there who have attained mastery of this science.*

*The background of the derivation and concept of yoga in India is presented followed by a simple exposition of yogic practices and some possible neurophysiologic explanations. Research in yoga will be rewarding as it gives means of exploring and enlarging the functions of the human brain.*

The concept of yoga can be assumed to be the peak of ancient Indian thought. The ancient Hindu, not only conned the horizon of nature and produced the **Vedas**, but also looked at human failings and imperfections and gave much thought to these problems. Unlike later thinkers of Europe, the Hindus turned their mind inwards, wanting to know the root cause o existence and seeking the source of joy and sorrow. They decided that there was nothing very much wrong with the environment but that man himself was the cause of his happiness or troubles. Hence they sought the means of improving the quality of man himself and yoga was the culmination of such thoughts and efforts.

The term “Yoga” is commonly used in India to indicate various aspects of a single entity. The words derived from the Sanskrit root ‘Yug’ to yoke i.e. to integrate or to combine, the ultimate desire or aim being the

integration of the individual soul (**Jeevatma**) with the universal soul **Paramatma** or God).

Yoga has also been variously defind and interpreted in the Indian literature. Yoga is equanimity. Yoga is efficiency in action. Yoga is the control of mind’s activity or “stoppage of the waves of the mind”. That last is the definition given by Patanjali, a great Indian seer and the master exponent of yoga. This and not the mere assumption of grotesque postures as imagined by some people in other parts of the world, is the proper explanation of yoga as understood in India.

It would be proper here to stress that the methods of yoga are not of mere historical interest. They form part of the lives of many people in India. Many Indians practice some elementary methods of yoga in their

---

\*Head of the Department and Neurosurgeon

everyday life; and children are taught their significance. A few Indians practice it often and have achieved that there are some ascetics found all over the country, who are the masters of yoga – (real yogis). This is subject of topical interest. Hence a better understanding of the basic physiology of yoga according to modern concepts is needed.

Before postulating a probable mechanism it will be useful if an explanation of the background and philosophical aspects of yoga are presented, as the system of yoga are presented, as the system of yoga is closely connected with and is based upon ancient Indian thought. The Bhagavad-Githa (Radhakrishnan 1948) and the Yoga Sutra of Patanjali (Swami Vivekananda 1944) explained clearly the philosophical and psychological aspects of yoga. In recent years, about 75 years ago, Swami Vivekananda visited the United States to attend the Congress of Religions and presented the Hindu philosophy of Yoga to the Americans.

According to the Bhagavad Githa, man can attain salvation (Integration of his soul with the universal soul) by many means. There are many paths to the top of the hill. One is Karma Yoga the path of action and duty. If a person does his job to the best of his ability without worrying about the fruits of his efforts, he is considered to be a yogi. Concentration of all his faculties on a given job is the characteristic of a yogi.

The second method of salvation is by devotion (Bhakthi) to the supreme power in

the form of a personal god-the method advocated by many religions of the world. The third method is by attaining a true knowledge of the universe and existence through metaphysics (Jnana Yoga, Jnana-to-know). All these paths converge towards the ultimate goal.

The method of real yoga as generally understood is the practice of concentration and meditation i.e., control of the mind. This is the method so well expounded by Patanjali in his Yoga Sutra. Here Patanjali starts by defining Yoga as “the control of mind’s waves”. The aim of such yogic practices is to have the fullest control over one’s own mind. The trainee practices intense concentration on any single thing preventing any other thought arising in the mind. Later, when such concentration (now called meditation) is directed towards the knowledge of the self or the ultimate reality, it becomes the state of Samadhi (A state of super-consciousness, as Samadhi is commonly defined). In this state of deep meditation the mind is in full grip with basic reality. According to Indian thinkers this ultimate reality is beyond time and space. It has neither name nor form. To be in unison with such ultimate reality is the aim of yoga. When such a state is reached the yogi transcends all the limitations of his body and rises above the ordinary physiological requirements of the normal human being.

To achieve this state of Samadhi is not easy. It requires constant practice and detachment does not mean giving up everything and going into the forest disregarding responsibilities. It refers to an attitude of

mind in which the person continues to work and live amidst all the pleasures and pains but still is not affected by them.

As a preliminary to Yoga, there are certain regulations to be observed, namely bodily cleanliness, mental cleanliness, nonviolence, truth and continence. These are given as the prerequisites for a good training in yoga. Man must not entertain thought of hatred, falsehood or enmity towards any being. This may appear initially to be a tall order, but by practice this mental attitude is said to be definitely achieved and is necessary to master the art and science of yoga. Once the general attitude of the mind is determined and set towards these pre-requisites, daily practice of yogic exercises are prescribed.

Adopting a posture (Asana) and control of breathing (Pranayama) are the chief basis for these exercises which help in mind control. These postures are known as Asanas. Originally Patanjali defined posture as one which is comfortable and which can be maintained for a long time. The commonest and easiest being the "lotus posture" with the legs crossed, while seated on the ground. In this posture, the spine can be held erect for a long time without strain. Slouching or slumping is not conducive to proper breathing exercises. Later exponents of yoga have enlarged and expanded the importance of postures or Asanas. Hundreds of difficult and different postures of the body are recommended to be practiced. They help in concentration. One system of yoga bases itself mainly on these (Hathayoga). This has also developed into a method of physical culture and a method of

prevention and cure of certain diseases. Such "asanas" are not to be confused with the main theme of yogic practices.

In a comfortable posture, the training of respiration is started. The inspiration, the pause and the expiration are controlled and timed. Initially the maintenance of the advised posture itself is irksome and breathing control difficult. The thought processes will also be flitting about. But gradually with practice it is found that the posture can be maintained for longer periods without tiring and that the control of breathing much easier. When ease is achieved in this practice, training in concentration of mind is begun. Later the duration of inspiration are gradually prolonged and the time ratio between them changed so that after sometime the body respires at the trainees will and not for its own requirements. When control over respiratory mechanism is achieved, it is said that the control of mind and thought becomes easy. In yoga it is advised that the mind be concentrated on objects that are beautiful, pleasant, powerful etc. Naturally what could be more beautiful and powerful than the concept of God himself Patanjali does not stress that belief in God is necessary to achieve yogic eminence.

Form these level of achievement control over other mechanism of the body becomes possible. Later it is believed that various supernatural powers are automatically acquired. Such a yogi can remain buried under the earth for hours or days, or go without food or water. He may be able to perceive the thoughts of others and

transcend time by knowing about the past, present and future.

What are the processes involved in these yogic practices and how do they correlate with our present ideas of the functioning of the nervous system?

Neurophysiologically speaking, it appears that a basic factor in yoga is pranayama, the control of respiration. Respiratory function can be more easily influenced than any other vital function and the yogi uses it as the first step in his control of the nervous system. When cortical higher brain control is achieved over one basic function, it is possible to achieve control over the basic functions like vasomotor etc.

When the cortex, the higher brain is establishing control over the lower medullary centers it would become easy for it to establish, a similar control over the emotional centers and the hypothalamus. Through the hypothalamus the autonomic system is brought under control. This may explain how Tibetan yogis are able to increase or diminish their body temperatures at will. It is mentioned that which Tibetan yogis graduate their achievement is measured by the number of wet blankets they can dry by spreading in the open air where the temperature may be below zero (Mircca 1958).

A number of functions classified as autonomous are not so for the yogi. He is able to control by will many functions that are controlled in ordinary human beings by sub-cortical areas. The mechanism involved

could be neurological and chemical. Once a steady regular control of respiration is achieved there is perhaps a reciprocal biochemical stability which helps in the maintenance of this control. Further autonomic control through the hypothalamus can presumably affect endocrine functions also favourably.

When man establishes full control over this lower vital and emotional functions by the exercise of his cortex (will) he has to do it by the reciprocal connections between the cortex, the reticular system and the various concerned centers in the brain. Constant yogic practice probably leads an enlargement of the scope of the function of the reticular system and of the cortex. It is quite possible that in a real yogi the reticular system and the cortex are both functionally altered and structurally proliferated.

The difficulty is in giving scientific proof to these speculations. Bagchi and Wengar (1957) undertook this difficult task in India in 1960 with some success. The real problem is get at the real yogis in India. One has to be on guard against fakes and charlatans who pose themselves as yogis. The real yogis are in inaccessible places and are not willing to be disturbed. Their one and only aim is the attachment or union with the absolute. Hence, any supernatural powers that the individual may develop vicariously during the course of yoga practices are frowned upon and the yogi is not encouraged to utilize these powers. It is specifically advised that the yogi should not fritter away his energy and concentration by utilizing these wide effects of supernormal

powers. Thus the real yogi is unwilling to lend himself to experiments. A possible path is to train volunteers who would be willing to undergo the strict discipline enforced by yoga and train themselves in yogic practices. On these volunteers, neurophysiological experiments could be conducted and a scientific explanation offered. This should not be too difficult when we are in the era of training astronauts to conquer space. In a symposium on man and his future Haldane (1963) put it clearly and boldly when he said "let us" for example suppose that it becomes possible to induce proliferation of the formation reticularis. If this possible in an adult it will first be tried by a trained psychologist who volunteers for the job. Perhaps the first two volunteers will report a great extension of consciousness while the third will go mad or

develop an impairable brain tumour. Or perhaps it may be impossible to induce proliferation in adult and it will be necessary to do it in babies. The exploration of the interior of the human brain will be as dangerous as that of the Antarctic continent or the depths of the oceans, but for more rewarding. To judge from the eagerness with which parents nowadays urge their children to risk their lives in the ward, and say that they have "given" their son if he does not return. I suspect that in a society with different ideals to our own, many parents would be prepared to risk their baby's life in the hope that it might develop supernormal powers.

It is only right to bear in mind that yoga is a real living art which can be put to great use by mankind.

## REFERENCES

Bagchi BK and Wenger MA: Electrophysiological correlates of some yogic exercises. The Fourth International Congress of Electroencephalogram and Clinical Neurophysiology, 1957. 'Excerpta Medica' Netherland p.25.

Haldane, J. BS: Biological Possibilities for the human species in the most ten thousand years in man and His Future Ciba Foundation Vol. 1963, Churchill, London p.358.

Mitrceda E: Yoga Immortality and Freedom translated from the French by Willard R.Trask, 1958. Pantheon Books New York p.331.

Radhakrishnan. S.: The Bhagvat Gita 1948, George Allen and Unwin Ltd. London. Swami Vivekananda – Raja Yoga or conquering the internal nature 1944. Advaita Asram. Almora.