

# SOME ASPECTS OF ELECTROENCEPHALOGRAPHIC STUDIES IN YOGIS<sup>1</sup>

B. K. ANAND, G. S. CHHINA AND BALDEV SINGH<sup>2</sup>

*Physiology Department, All-India Institute of Medical Sciences, New Delhi (India)*

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## INTRODUCTION

Yogis practising *Raj Yoga* claim that during *samadhi* (meditation) they are oblivious to 'external' and 'internal' environmental stimuli although their higher nervous activity remains in a state of 'ecstasy' (*mahanand*). Physiological and experimental studies have demonstrated that the basis of the conscious state of the brain is the activation of the reticular activating system through peripheral afferents (Magoun 1958), without which

*samadhi*. Some reports have already appeared on the subject (Das and Gastaut 1955; Bagchi and Wenger 1957), but the physiological mechanism of the state of *samadhi* still needs further elucidation.

## EXPERIMENTAL SUBJECTS

Scalp EEG was used to study the brain activity of Yogis during *samadhi*. Two types of yoga practitioners, who volunteered for this study, were investigated.

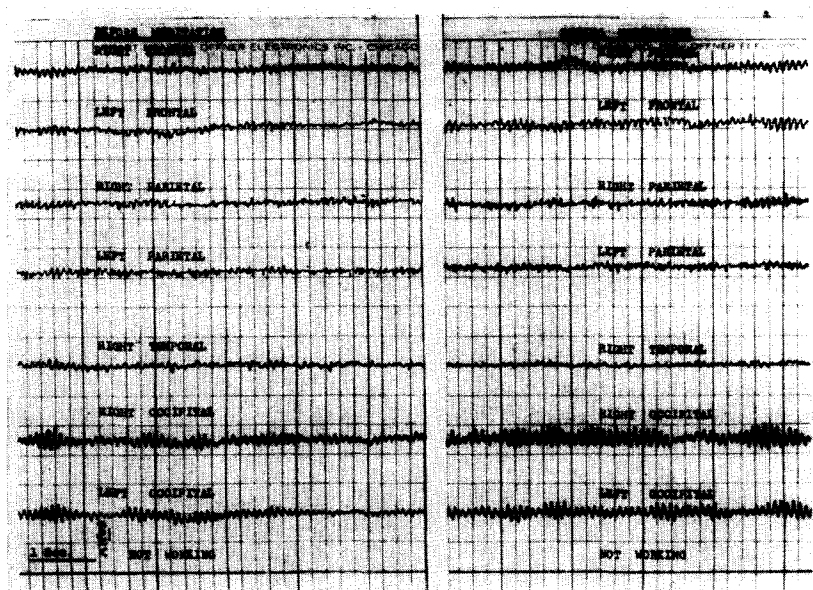


Fig. 1

Monopolar EEG scalp recordings of Shri Ramanand Yogi before meditation and during meditation. Reference electrodes on both ear lobes were joined together. During meditation there is a well marked increased amplitude modulation of alpha activity, especially in the occipital leads, where the amplitude increases from average to a maximum of 50–100  $\mu$ V. The frequency was between 11½ c/sec and 12 c/sec both before and during meditation.

higher nervous activity passes into the 'sleep' state. Studies were, therefore, undertaken to investigate electroencephalographically the activity of the brain during

## 1. Yogis practising meditation

Four Yogis practising *samadhi* had their EEG recordings taken before as well as during meditation. Two of them were exposed to 'external' stimuli which were photic (strong light), auditory (loud banging noise), thermal (touching with hot glass tube) and vibration (tuning fork). The effect of these on the EEG activity was studied both before as well as during meditation. One

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<sup>2</sup> Present address: Tirath Ram Shah Charitable Hospital, Delhi (India).

Yogi during *samadhi* also practised "pin-pointing of consciousness" (which means concentrating attention on different points of the vault of the skull).

## 2. Yogis with raised pain threshold

Two Yogis, who had developed increased pain threshold to cold water, were also investigated. They were able to keep their hand in water at 4°C for 45–55 min respectively without experiencing any discomfort. Their EEG records were obtained before and during the period when they kept their hand in cold water.

## RESULTS

The changes observed in the EEG records of the Yogis investigated are presented below.

### 1. Yogis practising meditation

All these Yogis showed prominent alpha activity in their normal resting records. During the stage of *samadhi* all of them had persistent alpha activity with well marked increased amplitude modulation (Fig. 1). In addition one of them showed occasional hump activity in the parietal

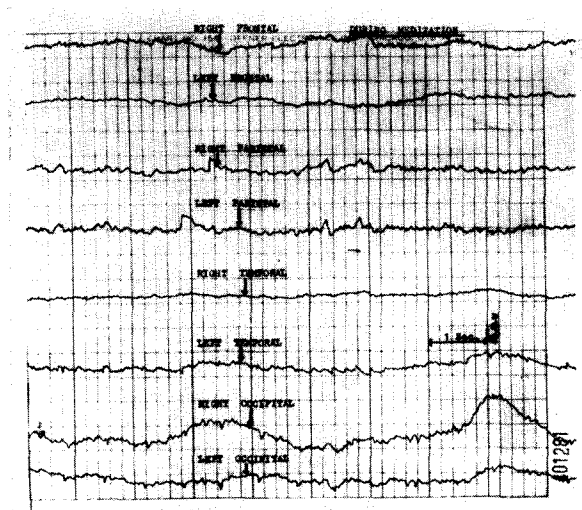


Fig. 2

Monopolar EEG scalp recording of one Yogi during meditation showing occasional hump activity in the parietal zones. For most of the remaining period of meditation he showed prominent alpha activity of 11–12 c/sec.

zones (Fig. 2), although he professed to remain awake throughout this period. In both the Yogis who were exposed to 'external' stimulation, all the stimuli blocked the alpha rhythm and changed it to a low voltage fast activity when the Yogis were not meditating. This blocking reaction did not show any adaptation to repetition of the same stimuli. On the other hand, none of these stimuli produced any blockage of alpha rhythm, when the Yogis were in meditation (*samadhi*) (Fig. 3). In the Yogi who concentrated attention on different points of the vertex ("pin-pointing of consciousness"), these attempts were accompanied by well marked 'blinking' responses recorded from the frontal electrodes (Fig. 4).

## 2. Yogis with raised pain threshold

The EEG records of these two Yogis also showed persistent alpha activity, both before and during the period in which the hand was immersed in cold water (Fig. 5). No change in the electrical activity in the parietal leads was observed even when sensory afferents from the hand were expected to be projecting there.

3. EEG studies were also made on a number of beginners in the various yoga practices. It was observed that those who had a well marked alpha activity in their normal resting records showed greater aptitude and zeal for maintaining the practice of yoga.

## DISCUSSION

In these experimental observations on Yogis, a persistent and well modulated alpha activity, more marked during *samadhi*, was observed. This alpha activity could not be blocked by various sensory stimuli when the Yogi was in *samadhi*, although it could easily be blocked when he was not meditating. Even during deep meditation when the Yogi appeared quite relaxed and in a sleep-like con-

dition, the EEG record showed only prominent alpha activity. Only in one Yogi was occasional hump activity observed, the alpha rhythm persisting in the rest of the period. Bagchi and Wenger (1957) also found the normal alpha pattern, sometimes with good amplitude modulation, in the EEG records of some Yogis during meditation. Okuma *et al.* (1958) observed in Zen practitioners that the alpha waves of these subjects increased remarkably with the progress of their performance, even if their eyes were kept open. Das and Gastaut's (1955) observations on high amplitude fast waves in the EEG records of Yogis during meditation have not been confirmed.

The significance of prominent alpha activity observed

during meditation is not yet clear. Yogis generally claim that during *samadhi* they are oblivious to their external and internal environments, and in the present experiments their alpha rhythm could not be blocked by external

beta rhythms are probably under the control of a sub-cortical pacemaker, or system of pacemakers. It is, therefore, suggested that the brain activity of Yogis during the stage of *samadhi* has for its basis a type of consciousness

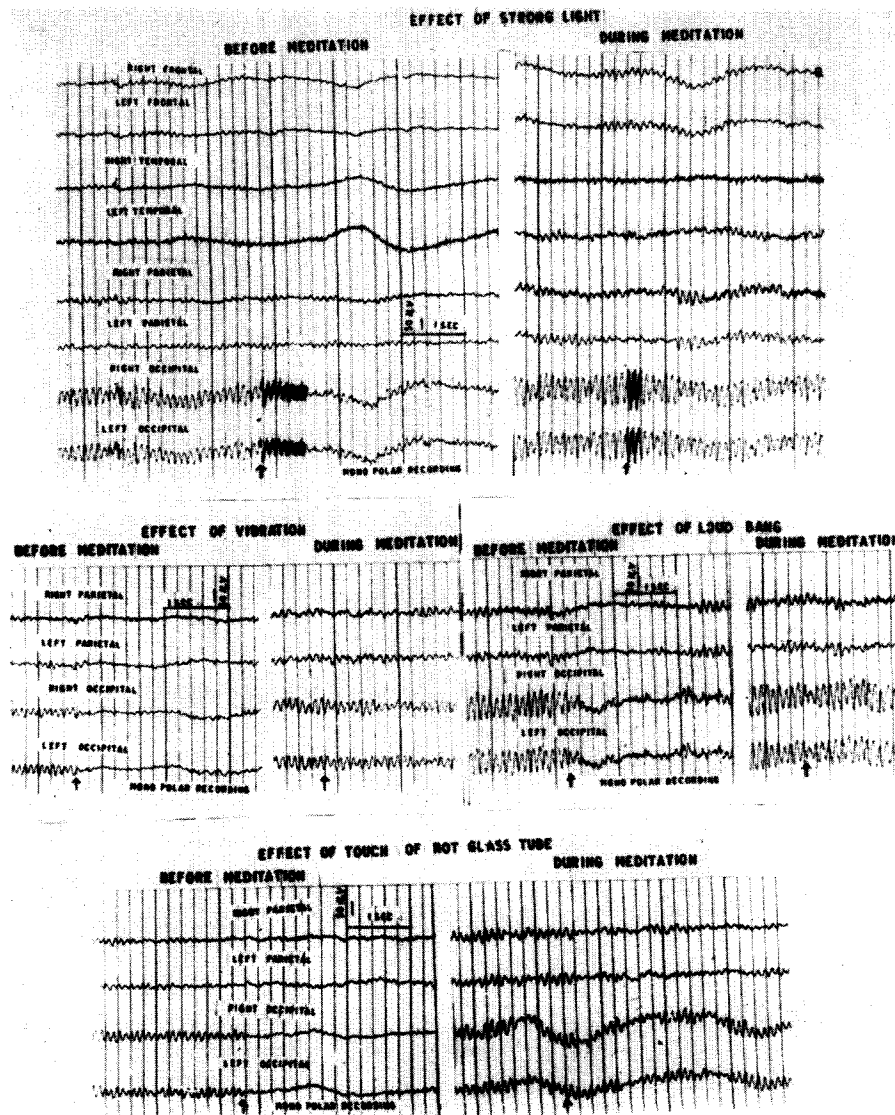


Fig. 3

Monopolar EEG scalp recordings of Shri Ramanand before meditation and during meditation. Photic, vibration, auditory, and thermal stimuli block the alpha rhythm when he is not in meditation. No blockage of the alpha rhythm occurs when he is in meditation.

stimuli. They also did not pass into delta activity. Although the reticular activating system (RAS) is activated by peripheral sensory inputs, it has also been reported that this system is capable probably of some spontaneous or autonomous discharge (Bremer 1954; Dell 1952). The alpha activity may be due to this discharge. Garoutte *et al.* (1958) have also observed that bilateral alpha and

which probably depends upon mutual influences between the cephalic RAS and the cortex, and which does not depend upon the activation of RAS through external and internal afferents.

The two Yogis, who could keep their hand without discomfort in ice cold water for long periods, showed alpha activity during this practice. This suggests again

that these individuals were able to block the afferents from activating the RAS and thus remain in alpha activity.

Lastly the observation that those beginners who had a well marked alpha activity in their resting records, showed greater aptitude for maintaining the practice of yoga, is quite important and may have some bearing on the problem under discussion.

#### SUMMARY

Four Yogis who practised *samadhi* were investigated electroencephalographically. It was observed that their resting records showed persistent alpha activity with increased amplitude modulation during *samadhi*. The alpha activity could not be blocked by various sensory stimuli during meditation.

Two Yogis, who could keep their hand immersed in ice cold water for 45-55 min, also showed persistent alpha activity both before and during this practice.

The possible mechanism of these observations has been discussed.

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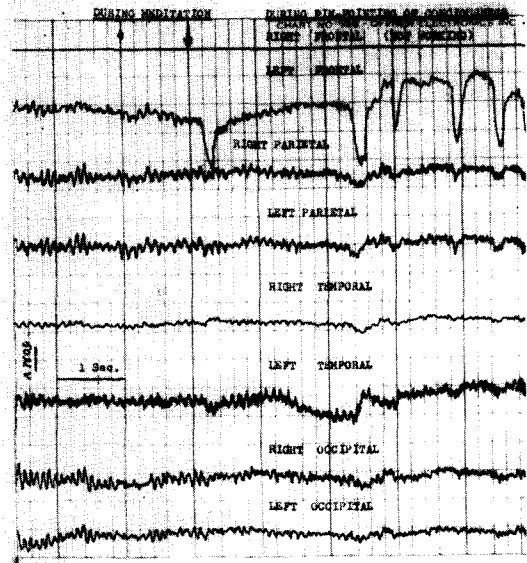


Fig. 4

Monopolar EEG scalp recording of Shri N.S. Paintal during meditation when he started concentrating his attention on different points of the vertex ("pin pointing of consciousness"). It shows a well marked blinking response from the frontal leads during this act.

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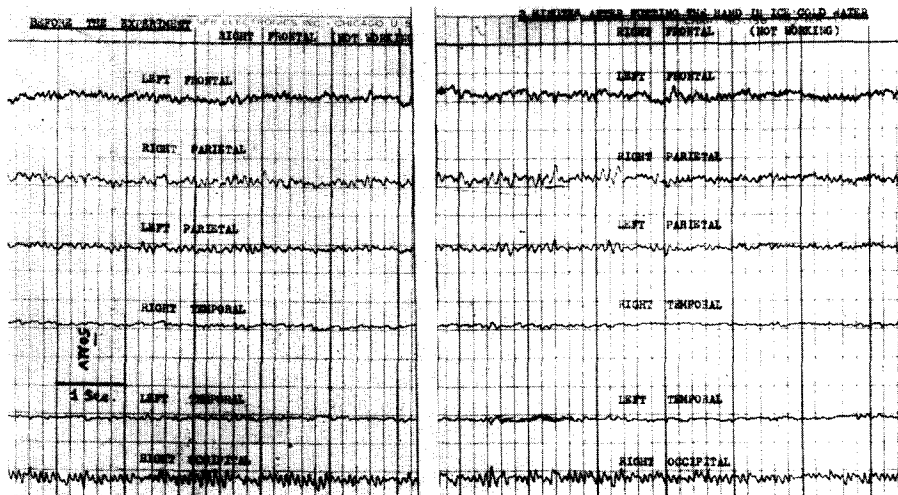


Fig. 5

Monopolar EEG scalp recordings of Shri Babu Ram Gupta who kept his right hand immersed in cold water at 4°C for 55 min. It shows records taken before the start of the experiment and 3 min after placing the hand in water. The alpha activity of 11 c/sec persisted throughout the whole period the hand was kept in water. No discomfort or pain was felt by him throughout this period.

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