

with brain disorders, may have trouble reaching this deep sleep. Thus their complaint of "not being able to sleep all night" has some basis in fact. They were probably in light sleep all night.

The last distinctive sleep pattern is REM (Rapid Eye Movement) or dream sleep. After the sleeper has progressed through all four stages, he will start back up again toward stage one. But, instead of coming to wakefulness, he enters a unique state: his brain waves are low, fast and irregular (like those of wakefulness), his breathing is uneven, his heart rate and blood pressure are acting up, and his eyes are darting around in their sockets. He seems as though he could be awake, yet nothing short of a blast on a horn will bring him to consciousness. He is dreaming.

Where do dreams come from? If the question is: why the bizarre images and what do they mean, there are no solid answers. But if the question reads: what provokes dreaming, a good answer is now available.

Dreams Originate in Pons

Dreams appear to originate in a most primitive part of the brain—the pons—located in the brainstem. Unlike other regions, the pons is quite independent of influences outside the nervous system.

From the pons, impulses seem to follow a path through the sensory channels and on up to the cortex—that part of the brain accounting for man's superior mentality.

When this routing of dreams is coupled with the recent discovery that newborn infants spend a good part of the day in REM dream sleep, the implications are enormous.

Three leaders in sleep research, Drs. Howard P. Roffwarg of Columbia University, Joseph N. Muzio of the New York State Psychiatric Institute, and William C. Dement of Stanford University, have found that newborns will spend half their sleeping time in the REM stage. Very premature infants may spend up to 100% in REM sleep.

The scientists suggest that this very active sleep is a central means by which the brain develops and matures.

Clearly, the day-old infant does not yet have a rich base of visual memories from which to draw dreams, but the researchers believe that some kind of rudimentary hallucinations are possible, even in the womb. Thus, "dreams" may prepare the tiny, immature nervous system for the onslaught of experience coming with birth. Soon after birth, the infant rapidly loses much of this REM sleep, presumably turning over the field to his newfound senses.

Extending their theory further, the scientists have risked an answer to the strangeness of dreams. If the primitive brainstem plays such a role in developing the cortex, perhaps the cortex thereafter fits normal visual images into the "unreal" structure of pre-birth imaginings.

During dreaming, when the brain is

no longer ruled by day-time reality, the strange patterns re-emerge.

As with most fertile research, the sleep studies have implications for other areas of investigation, principally in mental disorders.

Brain scientists are currently pursuing the notion of "feedback control." For instance, sensory impulses spreading into the cortex leave their mark on cortical cells, which in turn act back upon the sensory centers and influence cellular development there.

If the sensory areas should be somehow abnormal, the entire cycle gets off to a bad start, with each exchange reinforcing the abnormality.

Canada's Dr. Herbert Jasper, a leading brain scientist at the University of Montreal, believes the concept of feedback control will do much to illuminate the mysterious diseases of childhood schizophrenia and autism. The main stumbling block here has been that the pathology shows up so early in life. It seems implausible that the cause could be "poor parents" or a "bad home."

Combining Dr. Jasper's ideas with those of the sleep scientists leads to the thought that perhaps the kinds of hallucinations the fetus has in the womb set the stage for mental health or illness, before the brain's sensory centers ever get a chance.

What about the returns for normal people, so often ignored in the search for an explanation to disease?

Control Over Sleep Possible

At this moment, it seems entirely possible that man will be able to gain a measure of control over sleep. Evidence to support the assertion comes from a provocative piece of work done by Dr. Neal Miller at Yale University. Dr. Miller trained cats to enter a state of mind which would produce spindle patterns in the brain waves. Spindles occur only in the second and third stages of sleep.

Only the cat knows whether he was actually sleeping, but Dr. Miller said that while the EEG was tracing out spindles, the animal stood like a sphinx and stared glassily off into space.

That the control was voluntary is quite certain. Training began with an electric shock to the cat's pleasure center (in the brain) whenever he showed the spindles. Soon the cat was coming up with spindles spontaneously and regularly. It seems he had learned to sleep at will.

Conversely, when Dr. Miller rewarded an arousal pattern, the cat made an equally distinct change in that direction.

Other suggestive work has come from control of the alpha rhythm. The alpha is primarily a rhythm of relaxed visual centers. It disappears when the eyes are open and focused to attention. However, other things also block the alpha—sudden happiness, anger or mental concentration. LSD knocks it out altogether.

To Dr. Joe Kamiya of the Langley

Porter Institute in San Francisco, control of the alpha may be a way to train people to greater serenity. There have been reports that Buddhists show the alpha during their periods of meditation.

Alpha Rhythm State Serene

College students whom he educated to voluntarily induce or suppress the rhythm said that the mental state corresponding to alphas was serene, pleasant and devoid of imagery.

Dr. Kamiya thinks it may be possible to train people in controlling other waves and states of mind once they are defined and correlated.

Not everyone would agree with this hope, however. Beyond a general state of anxiety which will show distinctively on the EEG chart, the emotional counterpart of a brain wave cannot be identified, said Dr. Jasper. Further, the value of the alpha is highly questionable. Perhaps it is nothing more exotic than simple relaxation. "It may be like twiddling your fingers," he said. "What good is it?"

But even twiddling the fingers may be of some use to people if it brings momentary surcease from a pressure-cooker world.

SURGERY

England Plans 'Codes of Practice' for Livestock

► THE BRITISH Government has announced plans to set up animal care standards for farmers aimed at preventing unnecessary suffering of livestock.

Existing legislation does not sufficiently safeguard the welfare of livestock, according to the Minister of Agriculture, who said new legislation will be introduced giving the Government the power to prescribe "codes of practice" and to inspect animal farms.

No penalties will be included in the legislation, but non-compliance with the codes could be used in evidence against any farmer accused of causing unnecessary suffering.

The codes are directed at halting the practice of debeaking poultry, setting up minimum floor space standards for birds, pigs and calves; controlling the docking of pigs' tails; and reviewing feed-stuffs and husbandry practices in the raising of sheep and rabbits.

More research, however, is needed before regulations governing housing and husbandry can be firmly established, the announcement said.



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