Behavioral Sciences Notes

Gathered at the international meeting on the physiological effects of diffuse electrical currents

ELECTROANESTHESIA

Jamming the circuits

Electroanesthesia will probably become an adjunct to the arsenal of chemical anesthetics, not a replacement for them, according to Dr. Dominick Purpura, anatomist at the Albert Einstein College of Medicine.

Dr. Purpura says electroanesthesia, accomplished by passing currents through the brain, is not something that "every boy surgeon" is going to use. But it should be useful where other anesthetics are not readily available. The trick is to stay within a narrow range of electricity where the current is strong enough to cause unconsciousness but not strong enough to convulse the patient.

Electroanesthesia brings on unconsciousness by jamming brain circuits and disorganizing cell activity so that information transfer is cut off.

It makes no sense, Dr. Purpura says, to wonder whether the current is exciting or blocking the brain centers controlling consciousness. In fact, it's doing both.

Neurons react to an electrical current in fundamentally different ways depending on their location in the brain. Some are depolarized or excited; others are hyperpolarized or blocked. Electroanesthesia is bound to be an admixture of effects, in which disorganization, pure and simple, brings on unconsciousness, says Dr. Purpura.

MEMORY

An electrical base

In the search for physical memory, an English scientist has found new evidence of long-term electrical changes in the thinking neurons of high level brain regions.

Dr. O. C. J. Lippold of University College, London, stimulated individual cortical neurons in a rat for only five minutes. Yet for six hours afterwards, the neurons continued to fire spontaneously at elevated rates.

Dr. Lippold says he saw the same cell response when he pinched the rat's tail or pulled its whiskers. If he kept up the stimulation for five minutes and if the cells reacted at all, they would keep on firing for hours, almost as if the animal were remembering.

In the past researchers haven't been able to get these results, Dr. Lippold says, because they haven't stimulated animals long enough. The so-called plastic changes in electrical activity require at least five minutes of stimulation.

Dr. Lippold believes that if he has in fact tapped a basic memory process, it is probably long-term memory. The cell effect could not be abolished, as is usually the case with short-term memory.

EXPLANT EXPERIMENTS

Brain cells survive

Brain tissues taken from animal fetuses will grow in a test tube, build intercellular connections and, most important, exhibit complex electrical activity resembling that of living tissue.

The brain explant experiments, reported by Dr. Stanley M. Crain of the Albert Einstein College of Medicine, suggest that cultures may be highly useful as models for studying brain action.

Dr. Crain organized the tissue so that lower level explants—such as spinal cord material—were linked to higher level brainstem tissue.

He found that once the tissues, separated by gaps of one millimeter, matured and formed bridges, they began to exhibit complex bioelectric activity. An impulse, started artificially in the dorsal root ganglion, would set off spinal cord tissue which in turn triggered electrical discharges in brainstem explants. There was also evidence that the brainstem was affecting cerebral tissue.

Spontaneous discharges would often occur, says Dr. Crain, and were sometimes well synchronized between the explants.

CONVULSIONS

Chemical interference

Dr. Eduardo De Robertis reports new evidence on the chemistry of convulsions. He says drugs that produce convulsions seem to interfere with the enzymes responsible for making amino acids in the brain.

Dr. De Robertis of the University of Buenos Aires, was in the forefront of research that uncovered the chemical basis of synaptic transmission in 1954. The investigation established that impulses are sent from cell to cell by means of brain amines, such as norepinephrine, acetylcholine and serotonin, located in vesicles at the synapse or cell junction.

In his recent work, Dr. De Robertis correlated changes in this vesicle content with changes in enzyme formation.

SLEEP

Active inhibition

As scientists have lately suspected, sleep is an active process, not a passive one. Proof that some brain cells turn on in sleep to directly inhibit physical activity came from the University of California's Dr. Carmine D. Clemente, who has spent eight years on the problem at University of California at Los Angeles' Brain Research Institute.

Dr. Clemente says sleep cells, located in the basal forebrain, begin to fire during sleep, sending impulses to muscles and other parts of the body that say, "No, don't react, be inhibited."

He says he has seen the inhibition operating in nerves leading to muscles and suspects it also works in nerves leading to the upper brain centers.

Dr. Clemente views sleep as part of one large inhibitory system that vies with an active system for control of the body all the time.

"Normal behavior," he says, "is controlled by the functioning integrity of these two separate systems."

If the inhibitory system plays a part during waking hours, as well as during sleep, it could help to explain why some people are excitable, while others are calmer or even withdrawn.

With electrodes implanted in the basal forebrain of a cat, Dr. Clemente could put the animal to sleep within seconds after applying an electrical current, even while the cat had his teeth buried in the neck of a mouse.