SPONTANEOUS PERIODIC CHANGE IN ELECTROENCEPHALOGRAM

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During the course of study on alteration in EEG pattern produced by changing ventilation, we noticed spontaneous EEG fluctuation in which two types of activities alternated at regular intervals in about half the series of experiments. Cortical and subcortical electrical activity as well as phrenic nerve volley and blood pressure was recorded in curarized cats under artificial respiration. The periodic fluctuation was observed in the tracings from the hippocampus and, less frequently, from the suprasylvian and anterior sigmoid gyri. There was close correspondence between the periodicity of EEG waves and that of phrenic nerve volleys. The periodic change in the hippocampus generally consisted of rhythmic synchronized waves which started about 2 sec after the onset of phrenic volley, and desynchronized waves. In the neocortex recordings high frequency waves were associated with phrenic volley. The rate of artificial respiration and the change in blood pressure were also related to the periodicity in EEG activity.

When the bilateral vagi were severed the interval of phrenic nerve volleys was more or less prolonged. At the same time the interval of the periodic EEG changes was prolonged, whereas the pattern of blood pressure fluctuation remained almost unchanged as far as the rate of ventilation was kept unchanged. When the artificial respiration was temporarily stopped the pattern of periodic EEG activities changed in parallel with the change in the pattern of phrenic discharge (see Fig. 1), while the blood pressure exhibited rather monotonous alteration. After transection of the brain stem (pretrigeminal transection) the periodic EEG fluctuation was hardly noticed in most cases, and the coincidence between the phrenic nerve volley and the periodic EEG change was broken down.

These findings indicate the most intimate relationship existing between the activity of the respiratory center and the electrical activity of certain higher structures.

FIG. 1. Temporary arrest of artificial respiration prolonged the duration of phrenic nerve volley and that of the periodic EEG activity (rhythmic synchronized waves) in the hippocampus in a strikingly parallel fashion. PN: phrenic nerve, AS: anterior sigmoid gyrus, SS: suprasylvian gyrus, HIP: hippocampus.