Effect of Varied CO_2 Concentrations of Respired Air on the EEG of the Cat. (19093)

J. G. PIRSCH AND W. R. MCCRUM. (Introduced by W. R. Ingram.)

*From the Department of Anatomy, State University of Iowa, Iowa City, Iowa.**

The use of curarizing drugs has been widely accepted as a method for preparing the cat for electroencephalography. Their paralyzing action permits the recording of brain potentials with a minimum of artifact due to muscle activity. This procedure, however, necessitates the use of artificial respiration which introduces the possibility of changes in the gaseous content of the respired air due to the source of the air and rebreathing through the apparatus being used. This brings forth the question of effects produced on the electroencephalogram due to changes in gaseous content of the inspired air. Lennox, Gibbs and Gibbs(1) noted that increase in carbon dioxide tension of blood produced an increase in cortical frequency in the human subject. This observation was furthered by Gibbs, Williams and Gibbs(2) when they correlated decrease in carbon dioxide tension with a decreased frequency pattern in the human electroencephalogram. The problem then is to determine whether such changes occur in the EEG of the experimental animal and whether the changes in the gas tensions brought about by artificial respiration are of sufficient magnitude to produce these cortical changes. This experiment is an attempt to demonstrate these relationships in the cat.

Materials and methods. Nine normal cats were used for this study, and to decrease resistance and artifact effects on the recordings, a strip of the calvarium, one half inch wide and extending from the frontal sinus to the tentorium cerebelli, was aseptically removed from each. A suitable period was allowed for recovery and healing and electroencephalograms were then recorded. During the recording the animals were paralyzed first with 15 mg of dihydro-beta-erythroidine and then maintained in the paralytic state by a constant intravenous drip of the drug. The animals were maintained on artificial respiration by compressed air and gas mixture delivered through a device which regulated the frequency, pressure and volume of respiration. A valve system (constructed by Dr. M. D. Wheatley) was interposed between the air hose from the respirator and the tracheal cannula. The valves largely prevented rebreathing due to the apparatus. A continuous electroencephalogram was recorded and known mixtures of O_2 and CO_2 were substituted for the normal air supply, 10 minutes for each mixture, at intervals throughout the experiment. Recovery time on normal air was allowed between each mixture. The records were made with an Offner crystograph recorded from 3 monopolar leads, frontal, central and occipital, pasted to the scalp. The reference lead was attached to the ear. Samples of the record for each respiratory phase were analyzed for frequencies by actual measurement of the percentage of fast waves (12-25/sec.), intermediate (8-12/sec.), S_1 slow (4-8/sec.) and S_2 slow (0-4/sec.).

Results. The results of the frequency analysis of these animals are tabulated in Table I. There appears to be very little change in the frequency spectra with the various concentrations of gas that were used. A possible exception to this is the amount of fast waves resulting from the use of a mixture of 95% oxygen and 5% carbon dioxide; however, this difference may not be significant.

Discussion. The results of this experiment indicate that the use of artificial respiration in curarized cats when rebreathing is largely prevented would not seriously alter the EEG

* This work was aided by a grant from the Central Scientific Fund of the College of Medicine, State University of Iowa.

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TABLE I. Frequency Analysis of the Electroencephalograms With Various Gas Tensions.

Conditions	Frequencies in %: F waves, 12-25/sec	I waves, 8-12/sec	S_1 waves, 4-8/sec	S_2 waves, 0-4/sec
Normal air without valve	26	20	41	10
" " with "	35	19	35	8
100% O_2	35	24	34	8
95% O_2 and 5% CO_2	43	19	29	4
93% 7%	30	18	43	5
90% 10%	28	10	49	12

by introducing changes in carbon dioxide tension. If the apparent change in frequency introduced with the 5% carbon dioxide is significant, a safe margin is, nevertheless, present in the use of a normal air supply which contains about a 0.04% concentration of that gas. It must also be recalled that the amount of oxygen administered with the carbon dioxide is many times that found in normal air. Alterations in gaseous content due to air supply and equipment would, therefore, be slight in contrast to proportions used in this experiment, and cortical effects would be of minimal values.

Summary. In cats curarized with dihydrobeta erythroidin hydrobromide and under artificial respiration, changing from air to mixtures of 3 to 10% CO_2 in oxygen caused no significant change in the percentages of fast, intermediate and slow waves in the electroencephalographic spectrum. It is concluded that artificial respiration as used in experiments with curarizing drugs does not distort the frequency spectrum.

Received August 13, 1951. P.S.E.B.M., 1951, v78.

Blood Sugar Levels and Cataract in Alloxan-Treated, Galactose-Fed and Xylose-Fed Weanling Rats.* (19094)

REX E. STERLING† AND PAUL L. DAY.

From the Department of Biochemistry, School of Medicine, University of Arkansas, Little Rock.

Cataract has been produced experimentally in the rat by a number of means. Among them are riboflavin deficiency(1); tryptophan deficiency(2); the feeding of lactose (3), galactose(4), or xylose(5); and treatment with alloxan(6). The cataract of riboflavin deficiency may be distinguished with the aid of the ophthalmoscope from that seen in tryptophan deficiency, and each of these may be distinguished from the cataract resulting from the feeding of lactose, galactose, or xylose. The cataracts resulting from lactose-, galactose-, or xylose-feeding, however, are ophthalmoscopically indistinguishable. Darby and Day(5) found that those carbohydrates were cataractogenic which elevated

* Research paper No. 963, Journal Series, University of Arkansas. The data in this report are taken from a thesis submitted by Rex E. Sterling to the Graduate School of the University of Arkansas in partial fulfillment of the requirements for the degree of Master of Science.

† United States Public Health Service Predoctorate Research Fellow.

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