

Effect of Wheat Gluten Diet on the Electroencephalograms of Dogs.*

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Introduction. Wagner and Elvehjem¹ have shown that "running fits" or so-called "canine hysteria" can be induced in dogs by feeding a ration containing wheat gluten.

Convulsive seizures, typical of running fits, suggested the possibility that this condition might be related to epilepsy.² It seemed of interest, therefore, to determine the electroencephalogram changes, if any, which might be induced by wheat gluten feeding.

Method. Mongrel puppies ranging in age from 6 to 8 weeks were used in this work. Each animal was dewormed and dusted with D.D.T. before the beginning of the experiment. For a period of a week or more before the operation and during the period when normal electroencephalograms were taken the animals were maintained on a purified basal control ration.[†]

Under general anesthesia with phenylethyl-barbituric acid (Nembutal), 4 tantalum electrodes were placed extradurally about 10 mm posterior to the cruciate sulcus and 5 to 10 mm from the midline or just medial to the upper margin of the temporal muscles. The technic used here was the

same as is used in clinical electroencephalography except that the electrodes were anchored firmly to the bone in order to minimize movement.³ This was accomplished by twisting the wires over the bridge of bone between 2 adjacent holes in the skull. All records were taken without the use of any type of anesthesia or drug. Electroencephalograms were made on the dogs with a 6-channel recorder. However, records from only one channel are presented here as they are representative of the results. Wheat gluten was substituted for casein in the ration after several satisfactory normal records were obtained. Generalized convulsions were frequently observed after 3 to 10 days on the gluten ration; and often there was evidence of their occurrence, such as upset food containers and disturbance of the shavings in the cage.

Results. Eighteen dogs have been tested in this series of experiments. However, the data on only one animal are included here as they are representative of the results obtained. Electroencephalogram (E.E.G.) abnormalities were noted as early as 3 days after a dog was placed on a wheat gluten ration, while the maximum time for E.E.G. changes to occur in the animals studied was 24 days. Running fits have been observed in as short a time as 3 days while gluten has been fed for as long as 5 weeks during which period no epileptic seizures were observed. Variation in response seemed to depend somewhat upon the age and breed of the dog used. Data indicate that the E.E.G. changes appeared before any clinical abnormality was noted.

The control E.E.G. record (Fig. 1, July 28), made while the 7-week-old male puppy

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¹ Wagner, J. R., and Elvehjem, C. A., *J. Nutrition*, 1944, **28**, 431.

² Erickson, T. C., Gilson, W. E., Elvehjem, C. A., and Newell, G. W., *Annual Volume on Epilepsy*, 1946, presented December 14, 1946, to a meeting of the Association for Research in Nervous and Mental Disease, New York City.

[†] Casein 20, sucrose 69, salts IV 4, corn oil 5, whole liver powder 2. Oral supplements of 0.75 mg thiamine, 0.75 mg riboflavin, 0.5 mg pyridoxine, 0.25 mg pantothenic acid, 1 mg nicotinic acid, and 70 mg choline per kilo of body weight, and 4 drops of haliver oil were administered twice weekly.

³ Gibbs, F. A., *Medical Physics*, p. 361, Year Book Publishers, Inc., Chicago, Ill.

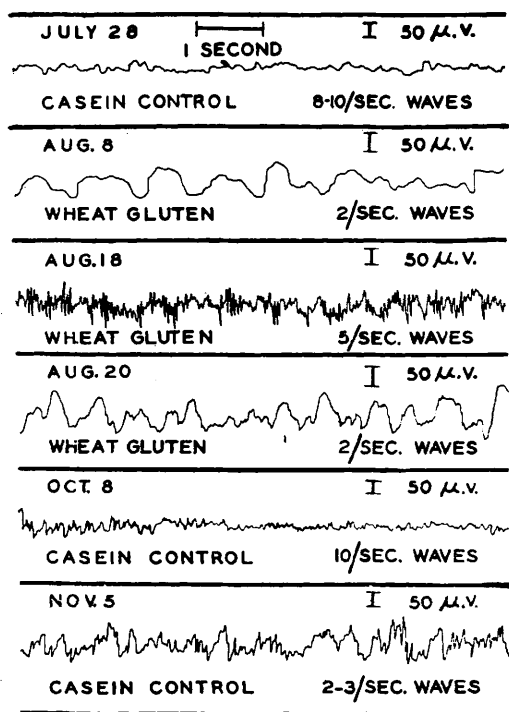


FIG. 1.

used in this experiment was on the basal ration, showed a moderate voltage activity with a predominant frequency of 8-10 per second. This same day the ration was changed to include wheat gluten in place of the casein. Eight days after this new ration had been fed the dog exhibited no change in behavior and a similar voltage activity and frequency resulted as was obtained with the control ration.

On August 8, 11 days after beginning gluten feeding there occurred a definite change in the electroencephalogram with the appearance of high voltage slow waves at a frequency of 2 per second. Three days later the same type of record was obtained although no outward change in the condition of the

dog could be observed. On August 18, a series of convulsions occurred and the record for this date was taken about 2 minutes after one of the convulsions had terminated. Here many spikes can be seen with some low voltage waves at a frequency of 5 per second. This record, taken immediately after a generalized tonic clonic convulsion, shows a typical seizure wave pattern. A record taken 2 days later, on August 20, shows occasional 1.5 to 2 per second high voltage waves. Both the seizure and interval E.E.G. were comparable to those seen in human epilepsy.

The following day, August 21, the casein control ration replaced the one containing gluten. On October 8, 7 weeks after the dog had been fed the casein control ration the E.E.G. showed a normal pattern with moderate voltage activity and 8-10 per second waves. After casein replaced gluten in the ration no further seizures were observed. Another record made 3 days later, not shown here, again showed a normal type of wave pattern. A check E.E.G. made one month later, November 5, showed a reversion to the type of wave pattern seen when the animal was fed the gluten. Occasional spikes are evident here with 2-3 per second wave activity. This fluctuating abnormality in the E.E.G. after gluten feeding was terminated has been observed in several dogs. In some animals seizures have been noted as long as 5 days after gluten was discontinued.

Summary. A method of obtaining electroencephalograms in dogs has been described. When rations which contained casein were fed no abnormalities were observed. After wheat gluten was substituted for casein epileptiform seizures and concomitant abnormalities in the E.E.G. developed which were comparable to those seen in cases of human epilepsy.