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**The effect of morphine on the mechanism of the dog's heart
after removal of one vagus nerve.**

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When injected intravenously, morphine was shown by v. Egmond to cause cardiac arrhythmia in dogs. Einthoven and Meek and Eyster studied the results of such injections electrocardiographically. Einthoven concluded that these were due to stimulation of the vagus centers. He found complete lack of uniformity in the results. Meek and Eyster believed the effects to be due to disturbances in conduction between sinus and auricle and between auricles and ventricles.

The similarity of some of Einthoven's curves to those resulting from faradic stimulation of the right vagus nerve and of others from stimulation of the left nerve rendered it probable that morphine sometimes had a preponderating influence on the right and at others on the left vagus nerve and center. Experiments were accordingly carried out in twelve dogs, in six of which the right and in six of which the left vagus nerves were removed aseptically. In 3 morphine was injected before operation. Registration was galvanometric. In three dogs (one right during three attempts and two left during two and three attempts) arrhythmia characteristic of morphine poisoning was not obtained.¹ In three it was obtained on the first attempt, in five on the second and in one on the third. In five right vagus and in four left vagus dogs injection succeeded and the resulting arrhythmias were directly comparable to those obtained on faradic stimulation. In the right vagus dogs the auricles, except for occasional contractions which escaped at long intervals, and also the ventricles ceased to beat. The circulation was carried on by ectopic ventricular contractions. That there was no defect in conduction was shown in a number of ways. In the left vagus dogs the auricles were merely slowed. There was depression in A-V conduction in all of them,—in three

¹ The dogs are named according to the nerve retained.

it was of moderate degree and resulted in an As-Vs ratio of 2 : 1 or 3 : 1. In another it was severe; except occasionally, the ventricles received no impulses from auricular contractions, but maintained the circulation by idioventricular contractions in complete dissociation with those of the auricles. All the dogs recovered.

The conclusions are warranted: that morphine stimulation of the vagus center in dogs having one vagus nerve only has the same effect as faradic stimulation of the same nerve in other dogs; that the results of the morphine method substantiates a former conclusion based on faradic stimulation that characteristic differences between the two vagi exist; and that the lack of uniformity found by Einthoven in the arrhythmia of the heart obtained on morphine injections is only apparent and is capable of analysis.

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The influence of temperature on the minimal dose of strychnin in frogs and on the time of onset of tetanus.

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Rana pipiens were used exclusively and all injections were given in the dorsal lymph sac. Temperatures from 40° F. to 80° F. were studied. With doses of 0.0006 mg. per gm. (about 0.02 mg. for a 30 gm. frog) tetanus was constantly obtained at all temperatures. With doses of 0.0005 mg. per gm. (about 0.015 mg. per frog) strong tetanus was obtained constantly at temperatures about 40° F. and about 80° F. It was occasionally seen at 55° F. and never at temperatures from 65° to 75° F. With doses of 0.0003 mg. per gm. strong tetanus was constant about 40° F. and occurred frequently at 80° F., but was never seen at temperatures from 55° F. to 70° F.

In regard to the time elapsing before tetanus; with minimal doses it is very variable but on the whole is less the higher the temperature. Thus with a dose of 0.0006 mg. per gm. tetanus came on at 40° after ½ to 4 hours; at 55° after 1 to 2¼ hours; at 70° after ¾ to 2 hours; and at 85° after ½ to 1 hour. With a