Benedict portable respiration apparatus, we convinced ourselves that these movements usually do not involve any respiration. Occasionally they are accompanied by expiratory movements, and more rarely by inspiratory movements. Whenever there is a respiratory movement, it is always followed by a temporary acceleration of the slowed heart. These occasional respirations apparently suffice to keep the duck alive under these circumstances and some animals were subjected to incomplete postural apnea of as long as 30 minutes' duration. However, 2 of our animals succumbed to postural apnea, death being preceded by a few terminal expiratory movements. We consider this phenomenon of importance, in that it shows that reflex inhibition of respiration may be stronger than the chemical stimulation by the venous blood.

Huxley considered postural apnea as a reinforcement of apnea produced by submergence. In our experiments in submerging a duck in the prone and supine position in a large glass aquarium, we never saw the head assume the position required for postural apnea (vertex downward). On the contrary, the head was always held in the normal position and the apnea which was produced can only be due to the wetting of the nostrils. We conclude, therefore, that postural apnea is phenomenon *sui generis*, independent of diving.

Some ducks are refractive as regards the elicitation of postural apnea. That is not the result of the conditions of the experiment. If a duck shows postural apnea it shows it at all times. We are now studying various breeds of ducks, because we have some evidence that this reflex apnea is characteristic of certain breeds only. This is a preliminary report.

[1] Huxley, F. M., *Quar. J. Exp. Physiol.*, 1913, vi, 147.
[2] Huxley, F. M., *ibid.*, 1913, vi, 159.
[3] Huxley, F. M., *ibid.*, 1913, vi, 183.
[4] Paton, D. Noel., *ibid.*, 1913, vi, 197.

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The Regulation of the Flow of Bile: III. The Rôle of the Gall Bladder.

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It has been demonstrated that the resistance to bile flow lies in the tenacity of the duodenum, rather than in the activity of a sepa-

rate sphincter at the orifice of the common duct.[1, 2] When the duodenum is in a normal state of tonus, the secretory pressure of the liver causes the bile to be stored in the gall bladder under pressure. Besides the intra gall bladder pressure caused by elasticity of the organ, it has been claimed that there is forceful contraction of its musculature in expulsion of bile.[3, 4, 5, 6] Hendrickson[7] has shown that the smooth muscle tissue of the gall bladder of man and dog is relatively sparse, and not arranged in coats, as we might expect of an organ possessing marked powers of contraction. However, if the gall bladder possesses strong capabilities of contraction, it should, when in such a balanced physiological state as to display tonus rhythm, respond to one of the following means of excitation: activity of the duodenum; hormone action; stretching, as when distended by bile; drugs that act either directly or indirectly upon smooth muscle.

In dogs under light anesthesia with a small rubber balloon in the gall bladder connected with a water manometer, normal rhythmical tonus changes were recorded. No relationship between these and activity of the duodenum was found to exist. Pilocarpine and eserin tended to increase the tonus while adrenalin and atropine had the opposite effect. Barium chloride produced definite augmentation of the tonus rhythm. No strong contractions were produced by drug action.

A fat meal never brought about contraction in cat or dog, even when the gall bladder was distended. Following such a meal the bile pressure is increased by hepatic secretion. When the pressure is sufficient to overcome the resistance of the duodenum, bile flows. Fats, by lowering the tonus of the intestine, lower this resistance. It would seem that the bile flow reported by Boyden[3] and Whitaker[4] in cat and man as due to active contraction of the gall bladder, might be better interpreted as due to peristalsis and lowered tonus of the duodenum.

Edema of the gall bladder developed in approximately 25 per cent of the dogs. Its onset was always characterized by a gradually increasing pressure with decreasing respiratory oscillations and the absence of rhythmical tonus changes. The pressure began to increase during the first hour, and reached a maximum only after 2 or more hours. Because of the similarity between this rise of pressure in the gall bladder, and that described by Higgins and Mann[5] as due to a contraction, and because of the fact that a physiological contraction of this nature is not known, it seems that they may have encountered edema.

The contractions reported by McMaster and Elman[6] as being efficient in expulsion of bile represent no greater volume change in the gall bladder than takes place in strong tonus rhythm. It is doubtful whether rhythmical tonus contractions can play any part in the expulsion of bile, since they disappear when the pressure in the gall bladder rises to the height necessary to overcome resistance at the duodenum.

These experiments, which will be published in detail in the *American Journal of Physiology,* seem to warrant the conclusion that the gall bladder is incapable of contractions that might be construed as being of major importance in the flow of bile. This is a preliminary report.

[1] Burget, G. E., *Am. J. Physiol.*, 1926, lxxix, 130.
[2] Copher, G. H., and Kodama, S., *Arch. Int. Med.*, 1926, xxxviii, 647.
[3] Boyden, E. A., *Anat. Rec.*, 1926, xxxiii, 201.
[4] Whitaker, L. R., *Am. J. Physiol.*, 1926, lxxviii, 78.
[5] Higgins, G. M., and Mann, F. C., *Am. J. Physiol.*, 1926, lxxviii, 339.
[6] McMaster, P. D., and Elman, R., *J. Exp. Med.*, 1926, xliv, 173.
[7] Hendrickson, W. F., *Johns Hopkins Hosp. Bull.*, 1898, ix, 221.

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What Causes the Psychic Secretion of Saliva in the Dog?

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It is a well known fact that a dog, when hungry, will salivate in the presence of food. Pavlov called it a natural conditioned reflex, developed in the animal as it learns to recognize certain matter as food. But is this salivation caused by the sight or the odor of the food? To answer this question I employed a number of dogs with fistulae of the submaxillary glands. These dogs were starved for a couple of days and then placed into a stand and a collecting tube attached to them in the manner described in another communication.[1] They were allowed to remain in the stand for varying lengths of time, as a control. In 30 to 60 minutes they generally secrete one or two drops of saliva. A perfectly transparent glass museum jar of prismatic shape was partly filled with cooked bread and meat, the fare that the dogs subsisted on for a year. The flat ground edges were covered with a slab of plate glass and sealed by means of vaseline.