as butterfly wings to objects for which high power objectives must be used, the apparatus has other desirable features. It projects images which are in every respect equal to those of commercial machines. Only the higher priced devices are equipped with nose pieces as found on microscopes. Little time is lost in adjusting the parts of the machine for projection, because its operation is very simple. The cost for materials and labor to construct the support and table was less than eight dollars.

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DEVICE FOR WASHING MICROSCOPICAL TISSUES

Devices for washing microscopical objects are legion. However, there is no method, so far as we know, that is satisfactory from every standpoint. Any device for washing tissue should meet certain requirements. In the first place it should be simple of construction so that the student of microscopy can prepare one in short order from the materials found around the average laboratory. In the second place the apparatus should thoroughly wash the objects, subjecting them to a constant stream of fresh water.

The following method is convenient to construct and has certain other advantages. A wooden block about 12 inches by 6 inches by 1 inch is provided with holes 1 inch in diameter and about ¾ inch deep, spaced at intervals of about 1½ inches, in which vials ⅞ inch in diameter are set. These vials are fitted with 2-holed rubber stoppers which fit tightly. The glass tube D (Fig. 1) is run through one hole nearly to the bottom of the vial. The other tube C projects through the stopper into the vial only a short distance. These are connected in series with rubber hose as shown in Fig. 2. Pieces of cheesecloth are tied over the inner ends of the rubber stoppers so as to cover the ends of the outlet tubes and prevent the objects from washing out. The hose A (Fig 2) is connected to the spigot and the other, B, is the outlet. A steady, gentle stream of water is allowed to flow through the vials for the desired length of time. This device insures thorough washing, for the objects are constantly agitated and revolved by the current of water. The whole apparatus may be placed out of the way at one side of the sink. A varying number of vials may be used according to needs.

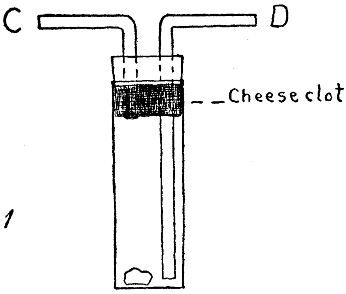

Fig. 1

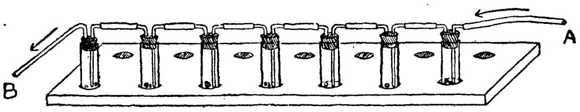

Fig. 2

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SPECIAL ARTICLES

THE EVOLUTION OF A CAROTID SINUS REFLEX AND THE ORIGIN OF VAGAL TONE

Reflex inhibition of heart rate has been observed in elasmobranchs upon mechanical or electrical stimulation of sensory endings distributed widely over the body, both externally and internally, including the gill region and the heart itself.[1] In mammals the sensory areas from which reflex cardiac inhibition may be obtained are limited, the most important being located in the aorta and in the carotid sinus.[2] Since in mammals an alteration of pressure within these blood vessels may be a physiological stimulus, the writers tried the effect of alterations of pressure within the branchial vessels of elasmobranchs.[3]

The ventral aorta of *Squalus acanthias,* with the cord destroyed, was ligated between the first and second branches and a cannula connecting with a burette, containing a physiological solution, was inserted anterior to the ligature. Cardiac inhibition was obtained when the pressure within the gill vessels was suddenly increased. A series of threshold determinations showed that an average increase of 10.7 mm Hg above the average systolic pressure in the dorsal aorta was found to constitute an effective stimulus for the inhibitory response. The response was found to be reflex, with afferent pathways located in the branchial nerves and efferent fibers in the vagus supply to the heart. Determinations of the blood pres-

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[1] B. R. Lutz, *Biol. Bull.,* 59: 170, 1930.

[2] J. A. E. Eyster and D. R. Hooker, *Am. Jour. Physiol.,* 21: 373, 1908; G. V. Anrep and H. N. Segall, *Jour. Physiol.,* 61: 215, 1926; C. Heymans, "Le sinus carotidien," Louvain and Paris, 1929.

[3] B. R. Lutz and L. C. Wyman, *Biol. Bull.,* 62: 10, 1932.

sure showed the average ventral aortic systolic pressure to be 28.2 mm Hg, the average dorsal aortic systolic pressure to be 15.4 mm Hg, and the average ventral aortic pulse pressure to be 13.3 mm Hg. The reflex cardiac inhibition, following the increased ventral aortic pressure which results from a spontaneous ejection reflex, lowered the ventral aortic diastolic pressure to a significant degree. The mechanism may therefore be considered of physiological significance and may be compared with the carotid sinus mechanism of mammals.

When the amphibian *Necturus maculosus* was used, reflex cardiac inhibition resulting from mechanical or electrical stimulation could be obtained only from the gills (Fig. 1). A sudden increase of vascular pressure within the gill vessels also evoked reflex cardiac inhibition, even when the burette pressure was as low as 34 mm Hg.

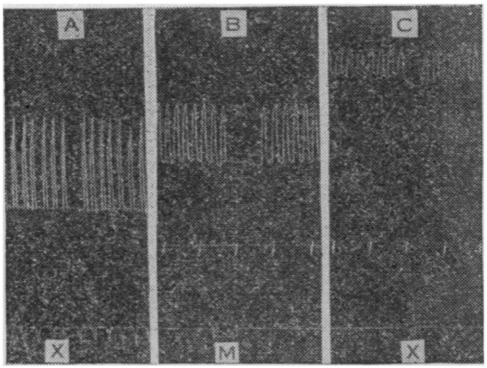

FIG. 1. Reflex cardiac inhibition. Heart beat recorded by lever. Time, five-second intervals. A. *Squalus acanthias*. Cord destroyed. Increase of pressure, at X, to 44 mm. Hg in the first branches of the ventral aorta. B. *Necturus maculosus*. Cord destroyed. Mechanical stimulation of left gills at M. C. *Necturus*. Decerebrated. Increase of pressure, at X, to 49 mm Hg in the ventral aorta.

It is conceivable, therefore, that in the course of evolution the wide-spread sensory areas of the ancestral form, possibly typified by the elasmobranch, with *Necturus* as an intermediate type, were concentrated or restricted until the condition seen in the mammal was reached. Since the carotid arteries of the mammal are derivatives of the primitive branchial system, the reflex cardiac inhibition of branchiovascular origin may exemplify the evolutionary forerunner of the carotid sinus reflex in mammals.

Inasmuch as the threshold for this reflex in *Squalus acanthias* was found to average 10.7 mm Hg above the dorsal aortic systolic pressure, and the average ventral aortic pulse pressure was found to be 13.3 mm Hg it follows that inhibition may occur with each heart beat. For example, in a typical case the ventral aortic systolic pressure was 22 mm Hg, the ventral aortic pulse pressure was 16 mm Hg, and the reflex was elicited when the pressure in the burette was raised to 18.6 mm Hg, a pressure well below the ventral aortic systolic blood pressure. Marked vagal tone of the heart has been found to exist in elasmobranchs.[4] It is suggested, therefore, that this vagal tone is initiated and maintained reflexly through the successive increases in blood pressure in the afferent branchial system due to the heart beats. It may be possible, however, that the vessels of the first two gills, isolated by the experimental procedure from the direct effect of the heart and exposed only to back pressure from the dorsal aorta, have become adapted to a lower pressure and show an abnormally low threshold. We have seen no evidence, however, for this supposition.

In mammals action currents synchronous with the heart beats have been recorded in the afferent vagus and in the cardiac depressor nerve.[5] Bronk[6] found action currents in the cardiac depressor and in the carotid sinus nerve of the rabbit coincident with the rapid rise of pressure in the pulse wave followed by comparative inactivity during diastole. This evidence and that obtained from the dogfish point to a special function of these afferent nerves, stimulated by the systolic pulse, in connection with the reflex origin of vagal tone. The phylogeny of a special physiological process in mammals is thus indicated.

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A LABORATORY EXPERIMENT IN ANIMAL BEHAVIOR

MOST modern courses in elementary biology or zoology include in the laboratory at least one exercise on reactions of living animals to stimuli such as light, gravity, touch, chemicals, etc. The animals which have been most frequently used in our own laboratories are Eisenia, Tenebrio larvae and Drosophila. Light responses of Eisenia and Tenebrio larvae are not easily studied in the laboratory which does not have suitable darkrooms available. This year we tried with considerable success a study of the responses of an animal which reacts readily to light under laboratory conditions.

Many fresh-water mussels are infested with para-

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[4] B. R. Lutz, *Biol. Bull.*, 59: 211, 1930.

[5] W. Einthoven, *Quart. Jour. Exp. Physiol.*, 1: 243, 1908; E. D. Adrian, *Jour. Physiol.*, 61: 49, 1926.

[6] D. W. Bronk, *Proc. Soc. Exp. Biol. Med.*, 28: 1014, 1931.