NOTE UPON THE MOVEMENTS OF THE INTESTINAL VILLI

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The structure of the villi of the small intestine is such that one would naturally infer that they possess the property of motion. Accordingly observations were begun on the living animal to see if such is the case. The dog was selected for these experiments.

The technique employed in performing the experiments is as follows:

The dog is anaesthetized with ether and the abdomen opened in the median line. A loop of the small intestine is picked up and passed through a slit in a thin board, or a slab of hard paraffin. The intestine is opened longitudinally for a distance of two or three inches opposite to the attachment of the mesentery and spread out and fastened to the board by means of tacks inserted into the board on each side of the slit, care being taken that the mesentery is not stretched nor pressed upon so as to interfere with the circulation or nerve supply.

The observations are then made by means of the binocular microscope, using a magnification of from 23 to 61 diameters. In dogs that have been fasting from 24 to 48 hours the villi are generally found extended, fallen over in various directions, and covered with a mucus-like substance. Local application of a few drops of any of the following solutions: — peptone, glucose, weak alkali solutions (sodium carbonate), dog's bile, diluted, physiological salt solution, or distilled water, is followed in a few seconds by the villi rising and beginning lashing-like movements in various directions. Very soon a second distinct movement begins which
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consists of an alternating shortening or retraction, and extension of various villi in the field. These movements are independent of peristalsis. The application of hydrochloric acid, 10 per cent solution, checks the movements, and the villi return to the resting condition, i.e., fall over and soon become covered with mucus. A 10 per cent alcoholic solution first stimulates, then depresses, and soon stops the movements entirely. The addition of water, or saline solution, 0.9 per cent, restores activity and the villi begin movements again. Intravenous injection of nicotine (1 mg. to 2 mg. per kilo) first stimulates, then depresses the movements, particularly that of retraction and of extension. Local application of solutions that caused active movements before the injection of the nicotine now have no effect. Atropine (1 mg. per kilo, intravenously) stops the movements. Local application of glucose, peptone, or other solutions that stimulated previous to the use of the atropine cause the lashing-like movement to return, but there is no retraction and extension.

From the observations thus far made, which have been quite constant on all animals examined, we reach the following conclusions:

First. That the villi possess distinct movements that are independent of peristalsis.

Second. That these movements are of two kinds: (1) A lashing movement, which may be supposed to aid in the mixing of the intestinal contents and thus promote the action of the digestive secretions as well as the process of absorption. This movement is not stopped by atropine. (2) An alternating retraction and extension, a form of movement which may be of special value in the act of absorption, particularly the absorption through the lacteals. This movement is abolished by both nicotine and atropine and is therefore under the control of the peripheral nervous mechanism. It may be regarded, probably, as a local reflex. Further investigation is necessary to determine whether the central nervous system is involved in this reflex.