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**Cutaneo-Visceral Vasomotor Reflexes in the Cat.**

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The use of localized cutaneous stimulation in the treatment of visceral and other deeply located lesions has been based mainly on empirical considerations. Certain investigators, particularly Boas<sup>1</sup> and Freude and Ruhmann,<sup>2</sup> advanced data which support the assumption that localized cutaneous stimulation by means of warm applications results in vasodilatation in the corresponding segments of the gastro-intestinal tract. Certain data also support the assumption that localized cooling of the skin results in vasoconstriction in the viscera in the corresponding segments. There is no general agreement regarding the vascular reactions in the viscera elicited by localized cutaneous stimulation or the mechanisms through which such reactions are brought about.

The present series of experiments has been carried out to determine more accurately than has been indicated by previous studies whether appreciable circulatory changes in visceral organs can be brought about by localized cutaneous stimulation and whether the changes which occur represent direct effects of the stimulation employed or reflex phenomena.

Decerebrate preparations of the cat have been used in order to avoid the vitiating effects of anesthesia. The stimulating agents employed have been warm and cold applications and vacuum cups applied to the skin of the back and lateral surfaces of the trunk from which the hair had been removed. The circulatory changes brought about in the stomach and intestine were observed with the viscus exposed through a midventral incision, and recorded by means of photography and plethysmograph records.

Moderate cooling of the skin of the back or lateral surface by means of cold applications from the fifth or sixth thoracic segment caudalward consistently resulted in vasoconstriction in the stomach and intestine. Moderate warming of the skin in the same areas by means of warm applications at approximately 45°C consistently resulted in vasodilatation in the stomach and intestine. (Fig. 1.) Stimulation of the skin by means of vacuum cups resulted in

<sup>1</sup> Boas, I., *Deutsch. med. Wchschr.*, 1926, **52**, 349.

<sup>2</sup> Freude, E., and Ruhmann, W., *Z. f. d. ges. exp. Med.*, 1926, **52**, 338.

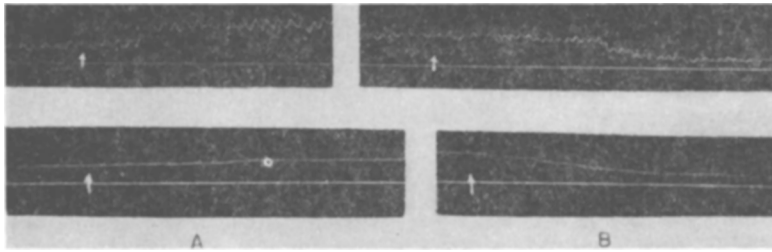


FIG. 1.

Plethysmograph records of a loop of the small intestine of the decerebrate cat during localized cutaneous stimulation by means of warm and cold applications. Initiation of stimulation is indicated by arrows.

A, Records of responses to warm applications.

B, Records of responses to cold applications.

vasodilatation in the corresponding portion of the gastrointestinal tract in approximately the same degree as moderate warming of the skin in the same area.

Photographs of segments of the gastrointestinal tract obtained during intervals of vasodilatation due to local warming of the skin and during intervals of local cooling of the skin, compared with those obtained in the absence of specific cutaneous stimulation, indicate that the changes in calibre elicited by means of the stimulation employed are more marked in the smaller blood vessels than in the larger ones. Direct observations under low magnification also support this conclusion. The changes observed and recorded are of sufficient magnitude to warrant the conclusion that the volume of blood circulating through the affected segments of the gastrointestinal tract is markedly increased by local warming and markedly decreased by local cooling of the skin.

The circulatory changes in the gastrointestinal tract observed in these experiments cannot be explained on the assumption that the gastrointestinal blood vessels were influenced directly by the stimulation employed, but must be regarded as reflex responses brought about through segmental and intersegmental reflex arcs including sympathetic neurons. The assumption that the sympathetic nerves in question include vasodilator fibers is supported by conclusive experimental data (Burn).<sup>3</sup>

Stimulation of the receptors involved in cutaneo-visceral vasomotor reflexes probably is associated with changes in the tonic state of the cutaneous blood vessels. In our experiments, prolonged application of warm packs resulted in localized cutaneous hyperemia which persisted for some time after removal of the stimulating agent.

<sup>3</sup> Burn, J. H., *Physiol. Rev.*, 1938, 18, 137.

During this interval cooling of the skin in the hyperemic area did not result in vasoconstriction in the gastrointestinal tract, nor did further application of a warm pack result in increased vasodilatation in the viscus. This is in full accord with the observation reported by Ruhmann<sup>4</sup> that local warming of the skin does not elicit reflex responses of the gastrointestinal musculature until dilatation of the cutaneous vessels in the stimulated area has taken place.

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**Response of Gonads and Gonaducts of Ambystoma Larvae to Treatment with Sex Hormones.\***

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For many years *Ambystoma* has served as an experimental animal in studies of sex differentiation and sex development. Such studies have been made principally by means of parabiotic union of larvae or by gonad transplants. Since synthesized crystalline sex hormones are now available it seems of interest to determine the effects of these compounds upon the sexual development of the same species of salamanders and to compare the results of such experiments with those obtained by the above mentioned methods.

First reports on effects of crystalline sex hormones on sex differentiation in *Ambystoma* were made by Burns,<sup>1,2</sup> who concluded that injection of testosterone propionate into *Ambystoma punctatum* larvae causes genetic females to differentiate in a male direction, while estrone causes differentiation of genetic males in a female direction. Ackart and Leavy<sup>3</sup> obtained results similar to those of Burns with injections of estrone into *Ambystoma tigrinum* larvae.

The animals used in our study were larvae of *Ambystoma maculatum* of two races, a differentiated race from Georgia, and a semi-differentiated race from Arkansas, and a small lot of *Ambystoma tigrinum* larvae from Iowa. The sex hormones used were estrone (Theelin: Parke-Davis Co.), estradiol dipropionate (Diovoeylin:

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<sup>4</sup> Ruhmann, W., *München. med. Wchschr.*, 1933, **80**, 17.

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<sup>1</sup> Burns, R. K., *Anat. Rec.*, 1938, **71**, 447.

<sup>2</sup> Burns, R. K., *Anat. Rec.*, 1939, **73**, 73.

<sup>3</sup> Ackart, R. J., and Leavy, S., *Proc. Soc. Exp. Biol. and Med.*, 1939, **42**, 720.