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Action of Certain Drugs on Isolated Intestinal Transplants.

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By an operative procedure previously described segments of small intestine were isolated from the remainder of the intestinal tract and transplanted onto the surface of the abdomen.[1] By applying electrodes attached to a string galvanometer to the segment, waves of altered electrical potential were obtained. Previous studies have shown that these potential changes probably arise from some cause within the segment itself because when all original connections with the central nervous system have been severed they persist in practically an unaltered form. The two most likely sources of this phenomenon are the intestinal musculature and the intrinsic nervous tissue which consists of the plexuses of Auerbach and Meissner. Gross observations and simultaneous myograms and electrograms have shown that there is a definite time relationship between muscular contractions and the electrograms.[2] However, the waves of altered electrical potential continue when no record of muscular activity can be obtained. In an effort to obtain further information of the nature and origin of the electrograms a series of drugs were administered intravenously and their effects noted. These are briefly summarized here.

Epinephrin was followed by a complete cessation of the myogram within 10 seconds but the waves of altered electrical potential persisted. Alvarez[3, 4] and his coworkers have noted similar effects of this drug. This may be explained by the stimulating action of epinephrin on the receptive mechanism of the sympathetic system, thus increasing sympathetic inhibition. The persistance of the electrogram does not rule out the possibility of myogenic origin. Physostigmin (0.1 mg. per kg.) was followed within 30 seconds by an increase in degree and duration of the contractile phase of the myogram but no marked change in the electrogram. Atropin was followed by a rapid diminution in the strength of muscular contrac-

[1] Puestow, C. B., *Arch. Surg.*, 1932, **24**, 565.

[2] Puestow, C. B., PROC. SOC. EXP. BIOL. AND MED., 1932, **29**, 901.

[3] Alvarez, W. C., and Mahoney, L. J., *Am. J. Physiol.*, 1922, **59**, 421.

[4] Berkson, J., Baldes, E. J., and Alvarez, W. C., PROC. SOC. EXP. BIOL. AND MED., 1932, **30**, 205.

tions until they became imperceptible, but again the electrograms persisted. As both these drugs are thought to act upon the peripheral distribution of the parasympathetics, the former stimulating and the latter paralyzing, and as neither of them greatly altered the electrograms, it suggests that the peripheral sympathetics have a stimulating influence on the strength of contractions but do not initiate or greatly influence the electrogram.

An effort was made to paralyze all the nervous tissue in the segment. If one could be certain of this he could determine whether the altered electrical potential arose in nervous or muscular tissue. A 1% solution of nicotine applied to the surfaces of the segment and injected into its wall did not totally suppress the electrogram. However, this dosage may not have been sufficient to eradicate nervous influence. Berkson,[4, 5] working with isolated strips of rabbit intestine found that when nicotine was added to the solution in which the intestine was immersed there was an alteration of both mechanical and electrical records followed later by vigorous, rhythmic muscular contractions but no manifestation of electrical activity. Cocaine in strengths up to 10% was applied to the mucosa and outer surface of the intestinal segments. The electrograms and myograms persisted. Ergotamin in large doses is said to paralyze the sympathetics and stimulate smooth muscle. Therefore if used with atropin both sympathetics and parasympathetics should be paralyzed. By using these 2 drugs together the myograms and electrograms were increased in amplitude.

Our knowledge of the exact action and dosage of these drugs is too uncertain to permit the establishment of definite deduction from their use. However, in conjunction with other observations these experiments suggest the close relationship of muscular activity to the electrograms obtained from transplanted intestinal segments and the possibility of a myogenic origin of the potential changes.

[5] Berkson, J., *Proc. Staff Meet. Mayo Clinic*, 1933, **8**, 24.