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Differences in the Active Transport by the Intestine of the Rat and the Guinea Pig

At present, the *in vivo* and the *in vitro* techniques are normally employed in the study of the various problems which affect the intestinal absorption of a substance. In the former, the everted intestinal sacs method is commonly used, while the latter usually involves the process of successive absorption; the problem to be solved being the determining factor in the choice of method.

The *in vivo* technique of successive absorption was developed several years ago by SOLS and PONZ (12) for their work on the intestinal absorption of various monosaccharides, and was found to be valid in the case of rats and dogs. Some years later, the validity of its application to the intestine of cats was confirmed by LARRALDE and GIRÁLDEZ (7).

Today, great interest is being shown in the study of the diverse mechanism of active transport in various species (9), and in this field there has been an increasing use of the *in vivo* technique of successive absorption (4, 5), even to the extent that it has recently been employed in studies on man himself (8). In view of the extended use of this technique, it appeared interesting to the present authors to investigate, its application to the guinea pig, an animal presently used in intestinal absorption studies (3). The present paper, therefore, presents the results of some experiments on guinea pigs in comparison with control experiments on rats.

Adult guinea pigs weighing between 300 and 600 grams were deprived of all food but given free access to water for a period of 24 hours prior to the experiments. The anesthesia was carried out with a 12.5 % solution of uretane administered intramuscularly at a dose rate of 1.5 ml/100 g of body weight. In order to avoid alterations in body temperature, the experiments were performed at a constant temperature of 30° C. The solutions to be absorbed were introduced at 38° C under a pressure of 12 cm of water in the intestine.

The absorption characteristics of the guinea pigs were found to be very different from those of rats; the latter animals being characterized by a very constant intestinal absorption rate within a concentration range of 2.77 mM to 0.3 M throughout 14 successive absorptions of 30 minutes duration, in spite of the great increase in the glucemia concentration, whereas gui-

TABLE I

Absorption of d-glucose through the intestine of the guinea pig *in vivo*

Nr. Animals	Glucose mM	Time minutos	Successive Absorptions (μM/cm)			
			1st Absorption	2nd Absorption	3rd Absorption	4th Absorption
27	2.77*	20	0.44 ± 0.018	0.49 ± 0.020	0.52 ± 0.022	0.55 ± 0.026
10	30.50*	30	4.12 ± 0.45	4.15 ± 0.41	4.13 ± 0.40	4.14 ± 0.45
19	305.00	30	19.00 ± 1.47	15.11 ± 1.73	13.80 ± 1.41	12.02 ± 1.53

* Sugar solutions isotonized with NaCl.

nea pigs under identical conditions were found to have a glucose absorption rate of approximately half that of rats which, moreover, was very susceptible to changes in concentration.

In the case of guinea pigs, it can be seen from the data presented in Table I that at a concentration of 0.3 M the rate of intestinal absorption shows an acelerating decrease with each succesive absorption, so that there is a statistically significant rate-drop of 16.4 % from the first to fourth absorption. On the other hand, at a concentration of 30 mM, there is virtually no change in the rate over the four periods. However, if the concentration is reduced to 2.77 mM the trend is reversed and an actual increase in the absorption rate is observed.

It might initially be suspected that the increase in absorption observed at low concentrations was due to the isotonizing effect of sodium on the glucose solutions. That this is not the case, however, was made clear from experiments in which a 30 mM solution of glucose isotonized by sodium was employed without any increse in the rate being observed, as shown in the accompanying table.

With rats, all sugars are not absorbed in a manner similar to the absorption of glucose and galactose, owing to certain factors already described by LARRALDE and GIRÁLDEZ (6), and later confirmed by other authors (10). Thus, in the successive absorption of sugars such as arabinose and mannose by the intestines of rats, a marked decrease in the rate between the first and second periods can be observed, but thereafter the rate is constant. With guinea pigs the absorption of glucose at a concentration of 0.3 M also shows a decrease, between the first and second periods — but at a different rate from that of rats —, this decrease is further accentuated in subsequent absorptions.

This marked contrast of the absorption characteristics of the guinea pig with those of rats is in agreement with results of recent research on the metabolism of the small intestine of both animals (2, 11), and is yet another proof on the variation in physiological behavior displayed by the different species in this field (1).

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