

Localization of Certain Indigenous Microorganisms on the Ileal Villi of Rats

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Long gram-negative chains of either rod- or coccal-shaped bacteria are localized on the villous epithelium in the rat ileum.

Laboratory studies of the gastrointestinal microbial flora of animals were extended recently through the use of techniques of frozen-section histology (4). Microorganisms of several types are now known to be localized on the mucosal surfaces of certain regions of the alimentary canal of mice and rats (3, 4). Lactobacilli and anaerobic streptococci form thick layers on the nonglandu-

For this work, rats were obtained from the Long-Evans and Sprague-Dawley strain colonies of Blue Spruce Farms (Altamont, N.Y.), the Sprague-Dawley colony of Charles River Breeding Laboratories, Inc. (Wilmington, Mass.), and the colony of unknown strain (the so-called Houston-Cheek rat) of the Cheek-Jones Co. (Tumball, Tex.). Usually, the animals were killed

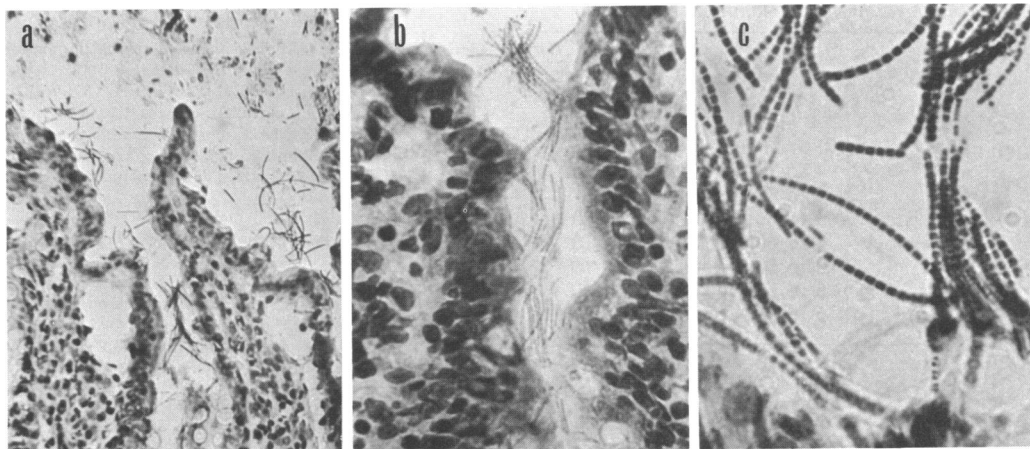


FIG. 1. Sections of frozen rat ilea, with contents intact, showing chains of coccal- and rod-shaped bacteria on the epithelium between the villi (hematoxylin and eosin: (a), $\times 400$; (b), $\times 1,000$; and (c), $\times 2,475$).

lar epithelium of the stomachs of all examined mice and rats over a few days in age (4). Yeasts populate the mucin in layers on the columnar secreting cells of the glandular stomachs of adult mice and rats from many colonies (3). Fusiform-shaped bacteria form layers in the mucin on the epithelium of the cecums and proximal colons of all examined mice (4) and rats (*unpublished data*) over about 2 weeks of age. This report deals with the finding of bacteria localized on the intestinal epithelium in another area, the villi of the rat small intestine.

and autopsied on the day of their arrival. When necessary, they were housed in metal cages, with pasteurized wood shavings for bedding, and given water and commercial pellets ad lib. Gravid females were observed twice daily; the day of birth of the young was determined as accurately as possible. Techniques of frozen-section histology and bacterial culture methods have been described (3, 4).

Figure 1 shows long chains of either coccal- or rod-shaped microorganisms between the villi of the distal portions of rat ilea. These microor-

ganisms are always seen in close proximity to the villous epithelium. The digesta and all other microorganisms are usually observed in the center of the lumen and rarely in the spaces between the villi (see top of Fig. 1a).

The microorganisms between the villi are gram-negative, show no internal structure in the light microscope, and are of a size characteristic of bacteria. In spite of their obvious bacterial characteristics, the long chains of cocci or rods have not yet been cultured in recognizable form *in vitro*. A variety of bacteria and yeasts have been cultured, however, confirming the results of others (2) that a rich microbial flora can be cultured from the rat ileum.

Almost every adult and weanling from the colonies of the rat strains examined, but not most of the sucklings of the Long-Evans strain, contained the chains of rods or cocci on the epithelium of the villi of their ilea (Table 1). Thus, these particular microorganisms colonize the ileum

only after the animals are weaned, but then persist throughout at least the 1st year of the lifespans of the animals.

At the present time, little is known about the factors involved in the microbial colonization of the gastrointestinal tract. It seems necessary, therefore, to withhold judgment on the significance of the timing of the colonization events until the factors that influence colonization are better understood. It should be emphasized, however, that the ileal microorganisms are present in all rats examined from weanlings to 1-year-old adults of the four strains from three colonies widely spaced in the United States. This fact, and their localization on the surface of the villi, makes it seem likely that a special ecological relationship may exist between these microbes and their rodent hosts. This speculation gains importance in light of the possible physiological interrelationships between animals and their gastrointestinal microflora (1, 5).

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TABLE 1. *Age distribution of rats of different strains with long chains of short coccal- or rod-shaped bacteria between their ileal villi*

Rat strain	Age	No. with bacteria/total no. examined
Long-Evans	0 to 21 Days	1/35
	4 to 10 Weeks	19/20
	6 to 8 Months	5/5
Sprague-Dawley ^a	5 to 6 Weeks	20/20
	Sprague-Dawley ^b	5 to 6 Weeks
Houston-Cheek	10 to 12 Months	10/10
	5 to 15 Weeks	10/10
	6 to 8 Months	5/5

^a Blue Spruce Farms.

^b Charles River Farms.

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