of the growth-factor for which they have a partial requirement. It has been shown previously, in the case of the completely dependent glycineless mutant, that the reversion frequency apparently decreases with increasing amounts of growth prior to plating on minimal agar. This was not due to an accentuation of a lower growth-rate of the reverted as compared with the dependent type. It occurred because extensive growth in the presence of glycine has a depressing effect on the abilities of the reverted cells later to express themselves phenotypically when plated to minimal agar[3].

The phenomenon described may have implications in regard to problems of differentiation and abnormal growth, since it reveals a mechanism by which newly formed, faster-growing cells can be specifically suppressed by an excess of the metabolite required by the parental cell type. A discussion of the possible basis for this inhibition phenomenon is being given elsewhere[4].

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[1] Witkin, Evelyn M., *Genetics*, **35**, 141 (1950).
[2] Wright, Barbara E., *Nature*, **168**, 1087 (1951).
[3] Wright, Barbara E., *C.R. Lab. Carlsberg, Sér. Phys.*, **25**, 173 (1953).
[4] Wright, Barbara E., *J. Bact.* (in the press).
[5] Wijesundera, S., and Woods, D. D., unpublished work quoted by D. D. Woods, First Marjory Stephenson Memorial Lecture, London (1953).
[6] Cohn, M., Cohen, G. N., and Monod, J., *C.R. Acad. Sci., Paris*, **236**, 746 (1953).

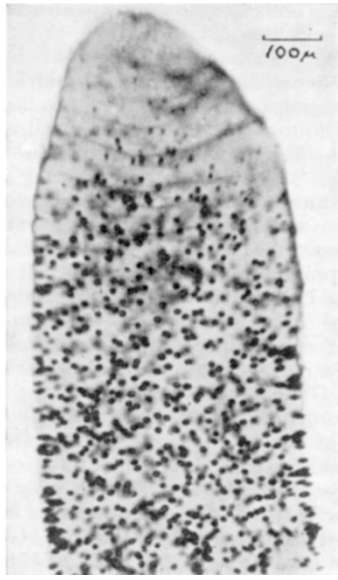
Mucus-producing Goblet Cells of the Small Intestine

IT is generally assumed that the intestinal epithelium is formed in the crypts of Lieberkühn. From this region of numerous mitoses the cells are presumed to move up towards the summit of the villi[1] from which they are shed. The average time required for the cells to pass through this phase has been calculated to be 1·57 days in the duodenum and 1·35 days in the ileum of the white rat[2]. How, when and where the goblet cells evacuate their mucus is not definitely known.

In order to answer this question I have endeavoured to make an evaluation of the intact cells. In ordinary histological sections it is impossible to account for all the mucous cells. By utilizing a method based on the preparation of intact villi and crypts by microdissection, staining the mucus of the goblet cells, and embedding in a suitably transparent medium, it is possible, however, to study the filling of intact cells with mucus and to determine their distribution in crypts and villi[3].

The experimental animals were cats, and the findings may be briefly summed up as follows: the goblet cells are most numerous near the bottom of the crypts; the number rapidly decreases towards their middle and remains nearly constant until the villus proper is reached. Here the density of goblet cells is practically constant upon the basal half, while a rapid decrease is evident towards the summit (see photomicrograph).

The cells contain small amounts of mucus near the bottom of the crypts. Then the mucus content rapidly increases and remains large all over the villus, except at the top, where the goblet cells are practically empty.



Intact villus from the small intestine of a cat. Staining: periodic acid, Schiff's method

These observations seem to indicate that the goblet cells are formed at the bottom of the crypts, where the quantity of mucus is scanty and the number of cells is large. Towards the middle of the crypts the goblet cells mature, and at the same time their number is considerably reduced. The decreasing density of the goblet cells in this region may be due to the mitotic activity of the intervening cells which push the goblet cells apart. In the cat, therefore, two generative zones exist overlapping each other only slightly: (1) deep in the crypts, there is a zone where goblet cells are generated; (2) higher up a zone of generation of columnar cells. From the crypts, the goblet cells move as components of the epithelial layer towards the summit of the villus, where they perish.

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[1] Bizzozero, G., *Anat. Anz.*, **3**, 781 (1888).
[2] Leblond, C. P., and Stevens, C. E., *Anat. Rec.*, **100**, 357 (1948).
[3] Moe, H., *Stain Tech.*, **27**, 141 (1952).

Development of Intranuclear Inclusions in Virus-diseased Cells of Lepidopterous Larvæ

FOR some time now, Dr. K. M. Smith and I have been studying, in sections for the electron and light microscopes, the role of intranuclear nets which form in insect cells infected with nuclear polyhedral viruses[1], and we are accumulating more and more data indicating that the polyhedral and previrus materials may originate in these nets. One of the biggest difficulties has been the lack of adequate cytological techniques for critically recognizing and differentiating the various intranuclear particles, and their relations to each other. Recently, Mazia *et al.*[2] published a new cytochemical method for the study of proteins using bromophenol blue as the dye, and this method, together with appropriate pretreatments of Carnoy-fixed sections, has now been used along