

appearances presented by the parenchymatous cells, the author concludes that they originate external to the vesicles by exerting pressure on the epithelial wall of the vesicles; they then produce a flattening and absorption of the same, and finally make their way through it into the interior of the vesicle.

The author in conclusion points to the *morphological identity* existing between the contents of the lymphatics and those of the vesicles—the contents, namely, of both appear during life to be a viscid substance which, in sections of hardened specimens, present a like morphological aspect, and stain in a similar manner with reagents. This identity, if proven in other respects, will go far to show that one, possibly the chief, function of the thyroid gland is the formation in the vesicles of a material which is carried by the lymphatics into the general circulation.

This paper is accompanied by nineteen drawings illustrative of the lymphatics and parenchyma of the glands.

#### IV. "Research on the Minute Anatomy of the Alimentary Canal."

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(Abstract.)

This research was commenced and carried on for the first fifteen months under the direction of Dr. Klein; during the last year it was continued independently.

Chapter I. describes the minute anatomy of the mucous membrane of the small intestine and the method of fat-absorption.

The author commences the Chapter by giving a history of the researches of previous observers, and the methods he employed for hardening and staining the tissue. He then gives a description of the minute structure of the mucosa.

The following are the results obtained.

1. The *epithelium*.—Lymph-corpuscles are constantly found among the epithelial cells of the intestine. Further it is found that the epithelium contains a reticulum continuous with the reticulum of the mucosa; this reticulum appears in horizontal sections of the epithelium as small branched cells, which sometimes show a nucleus. In vertical sections the reticulum is seen as a dark line at the base of the epithelium, and from this dark line fine processes run among the epithelial cells. The reticulum is stained very deeply by chloride of gold or by hæmatoxylin.

In teased preparations, if the epithelial cells are isolated, shreds of the reticulum are seen to be attached to the separate cells.

The epithelial cells are described as being closed at their free extremities.

Groups of young cells are found. These groups ("epithelial buds") are due to germination.

2. The *membrana propria* covering the villi is composed of large cells. In vertical sections the cells are seen to be round or oval, and lie close below the above-mentioned dark line. When the membrane is separated from the rest of the tissue, it is seen to be composed of these cells arranged as an endothelium. The *membrana* has holes or gaps in it; and in teased preparations the superficial capillaries are always attached to it, as the large cells partially surround the vessels. Villi which are denuded of their epithelium are bordered by these large cells, and not by the dark line, as the reticulum (which forms the dark line) breaks off with the epithelial cells.

In oblique sections of the villi the reticulum is seen to surround the cells forming the *membrana*.

3. The *membrana* of Lieberkühn's crypts, when isolated from the surrounding structures and viewed from above, is found to be a homogeneous membrane with nuclei imbedded in it. In oblique sections of the membrane *in situ* it is seen to be composed of cells, and the reticulum is found to surround the cells composing it.

4. The muscle-endings in the mucosa.—In cross sections of the muscle-fibres of the *muscularis mucosæ*, a reticulum is seen to surround the individual muscle-fibres; this reticulum is continuous with that of the mucosa.

The author next describes the manner in which the muscle-fibres terminate in the rabbit's colon. The individual fibres are attached to the large cells forming the *membrana propria* by means of the reticulum.

This reticulum must therefore be regarded not only as a network of threads, but as forming in places membranous investments.

5. The muscle-fibres in the villi have an adventitia formed by the reticulum of the villus; if the muscle-fibres end near the *membrana*, the adventitia may be attached to the endothelial cells forming the membrane.

6. The blood-vessels are found to have an adventitia formed by the reticulum. In the veins the reticulum surrounds the endothelial cells and *even passes between them*. In the arteries the reticulum surrounds the muscle-fibres; and where the latter are few and scattered, the reticulum forms a very definite adventitia to the vessel.

7. The chyle-vessels are also found to have an adventitia formed by the reticulum; *i. e.* in longitudinal sections of the vessel threads are seen attaching the vessel to the reticulum. The reticulum can be seen to penetrate between the endothelial cells in the same manner as in the veins.

8. The tissue of the mucosa is shown to be composed everywhere of a reticulum and of cells held in its meshes. The author finds that while there is no difference, or only slight differences, between the reticulum

of the villus and that of the lymphatic follicles, there are considerable differences between the cells of a lymphatic follicle and those of the villi. In the villi the cells are polygonal, with oval nuclei and faintly granular protoplasm; the cells are arranged as an endothelium, and can hardly be distinguished from the endothelial cells of the membrana propria, of the blood-vessels, and of the lymphatics. A gradual transition is found from the spherical lymph-corpuscles of the lymphatic follicles to the polygonal cells (connective-tissue corpuscles) of the upper part of the villi.

It is found that there are more lymph-corpuscles in the villi of some animals than in those of others.

The author concludes that "the mucous membrane of the intestine is pervaded everywhere by a reticulum, similar to and continuous with that found in the lymphatic follicles of Peyer's patches. This reticulum is situated among all the other elements which are contained in its meshes. This is true of the epithelial cells, the muscle-fibres, the cells of the parenchyma, the endothelial plates of the membrana propria, of the blood-vessels, and of the lymphatics."

9. Fat-absorption by the reticulum—(a) *by the reticulum between the epithelial cells.*—The fat is seen to be arranged in lines between the individual cells on viewing the epithelium from above. The separate cells in teased preparations appear to contain fat; but it is considered that this appearance is due to the fat-particles in the attached threads of reticulum.

The paper then relates the different situations in which this reticulum has been seen (as in the salivary glands, rete Malpighii of the skin, serous membranes, epithelium of the respiratory tract, &c.), with the different views which various authors have held concerning it.

(b) *Fat-absorption by the reticulum of the villus.*—During absorption fat is found to travel by the reticulum.

Chapter II. gives an account of the minute anatomy of the pyloric end of the stomach. This chapter commences by a short history of previous researches, then follows a description of the minute structure. The following are the results obtained:—;

1. The surface is seen to present somewhat parallel folds; the stomach-tubes opening on the summits of these folds are longer than those which open in the depressions between the folds.

2. The epithelium is described as being closed during inanition, but open at its free extremity during secretion.

3. The germination of the epithelium is next described. The conclusions arrived at are:—that the epithelial cells divide; that the small rounded cells (other than the lymph-corpuscles) are the products of their division; that these small cells, increasing in size, rise up among the older cells, push them to one side and become short broad cells; that the

short broad cells divide longitudinally, and form groups of two or three, or even more cells, which the author calls "epithelial buds."

4. A reticulum among the epithelial cells is described: it is found to be very delicate, and does not extend to the surface.

5. The membrana propria is found to be composed of large cells.

6. The muscle-endings in the plicæ villosæ are similar to those in the colon of the rabbit, already described.

7. Perivascular spaces are found in the upper part of the plicæ villosæ; these spaces are bordered by endothelial cells: the membrana propria forms the upper wall of the space.

8. The proper gland-tubes.—A fine reticulum is described as occurring among the epithelium of these glands. The nuclei are found usually as flattened disks lying at the base of the cells. The nuclei are, however, during digestion occasionally found to be spherical in form. A third kind of nucleus was also found, which was possibly intermediate between the two other forms.

Chapter III. describes the mucous membrane at the point of transition between the stomach and intestine: after giving a short history of the subject, it is shown that in many animals Brunner's glands are only the continuation of the proper glands of the stomach. Part of the proper gland-tubes break through the muscularis mucosæ, and then the glands are situated in the mucosa and submucosa; finally they are only found in the submucosa.

The mucosa at the point of transition was found to contain lymphoid follicles in very varying amount, the mucosa being in some animals almost free from them, and in others composed in a great measure of lymphatic tissue. This latter condition was found to be the case in dogs which were kept on a very reduced diet.

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Transactions.

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