

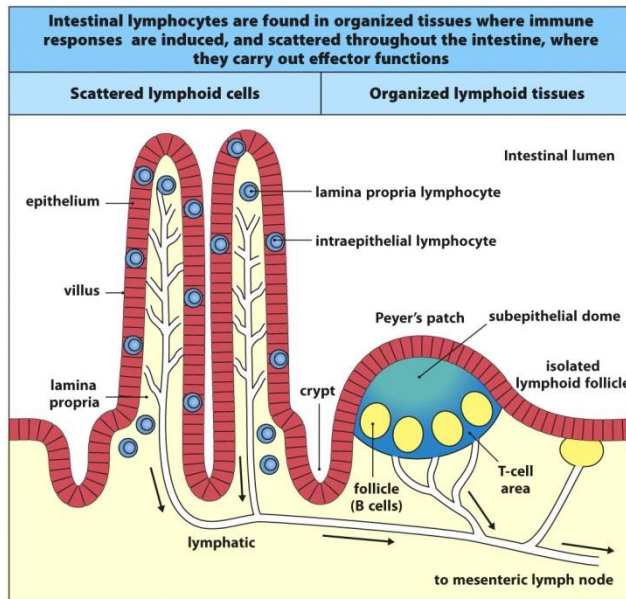


Figure 12.5 Janeway's Immunobiology, 8ed. (© Garland Science 2012)

There are about 100-200 Peyer's patches in the human intestine. Peyer's patches are extremely important for the initiation of the immune response in the gut. They have a distinctive dome-like appearance because of the aggregation of lymphoid cells in the intestinal lumen. Each Peyer's patch consists of a large number of B cell follicles with germinal centres together with smaller T cell areas that are found between and immediately below the follicles. The sub-epithelial dome is rich in dendritic cells, T cells and B cells.

← This is the small intestine (not colon because there are no Peyer's patches in the colon).

The villi are closely associated with Peyer's patches. The Peyer's patches drain into the mesenteric lymph nodes (which are associated with the gut, other lymph nodes are usually very small but these are very large and have a distinctive structure).

Overlaying the epithelial tissues and separating them from the gut lumen is a layer of follicle-associated epithelium.

The epithelial layer is made up of two types:

- 1) **Enterocytes** - form the surface of the gut, microvilli, produces a lot of mucus, and secretes digestive enzymes.
- 2) **M cells** - associated with the mucosal immune system - no microvilli, folded membrane; they are more submerged than enterocytes and have completely different structure.

The M cells do not secrete digestive enzymes or have glycocalyx which makes them readily accessible to organisms and antigens within the gut lumen and are the route via which antigens enter the Peyer's patches.

Next to the Peyer's patches you see the isolated lymphoid follicles; they are present both in the small intestine and the colon. They comprise mostly of B cells but some M cells too. Distinct from Peyer's patches which are present in fetus, but the isolated lymphoid follicles are thought to appear in response to the commensal microbiota after birth.

Both the Peyer's patches and the isolated lymphoid follicles drain into the mesenteric lymph node.

Antigens must cross the epithelium before they can stimulate an immune response. The Peyer's patches are designed for that function. The M cells in the follicle associated epithelium are the front line of the mucosal immune system. They are always sampling the environment by taking up antigen by endocytosis or vesicle encapsulation or phagocytosis. It is all taken up to the other side of the epithelial layer not exposed to the lumen where there are a lot of immune cells waiting.

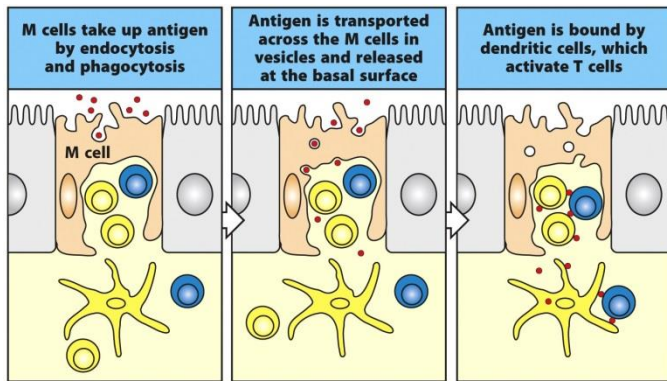
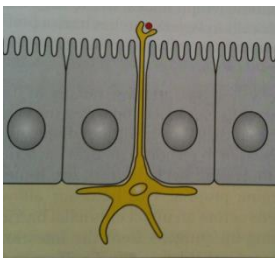


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The M cell structure has a folding which forms a pocket that encloses lymphocytes and dendritic cells in the lumen of the gut. The dendritic cells undergo the process of antigen presentation and then present the antigen to the T lymphocytes.

The dendritic cells are called into this area by chemokines (e.g. CCL20 and CCL9) constitutively released by the epithelial cells. The antigen loaded dendritic cells migrate from the dome region to the T

cell areas of Peyer's patch or via the draining lymphatics to the mesenteric lymph node. In both areas they will encounter a naïve T cell.



The dendritic cells can extend processes between the cells of the epithelium without disturbing the integrity of the layer to pick up antigens and bacteria from the gut lumen without the help of M cell.

The mucosal immune system contains large numbers of effector lymphocytes even in the absence of infection. In the intestine these effector cells are found in two compartments: the epithelial layer and the lamina propria. These two layers are distinct despite being separated only by a layer of basement membrane.

The vast majority of the lymphocytes in the epithelial layer are CD8+ T cells. It also contains dendritic cells. The lamina propria contains CD4+ and CD8+ T cells, plasma cells, macrophages, dendritic cells, eosinophils and mast cells. Neutrophils are rare in a healthy intestine however, their numbers increase rapidly during infection. The total number of lymphocytes in the epithelium and the lamina propria probably exceeds that of most other parts in the body.

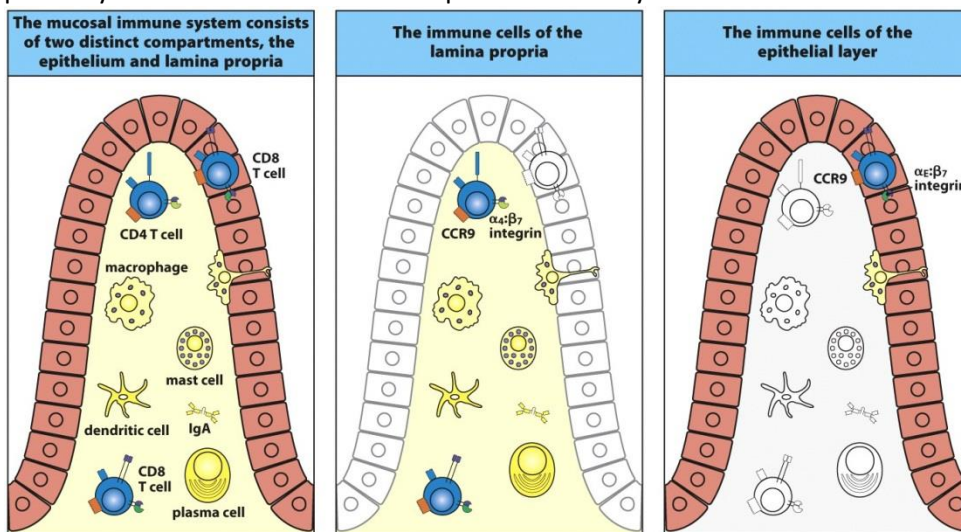


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